3068
Am3

LIBRARY
RECEIVED
FEB 26 1938
Dept. of Agriculture

AMERICAN
DYESTUFF REPORTER

DEVOTED TO THE INTERESTS OF TEXTILE CHEMISTRY
BLEACHING ◆ DYEING ◆ FINISHING ◆ PRINTING

LUME 27 FEBRUARY 21, 1938 NUMBER 4

Start your Greys and Taupes

with a real Grey

Greys and Taupes on Woolens should be started with an out-and-out grey; one providing a less variable base for shades requiring such delicate balance of color.

A good "starting" Grey is Geigy's

POLAR GREY

a product having the universally known and accepted fastness of the Polar Color series and suitable for all branches of fast, wool dyeing in combination with other Polar or Acid Colors employing weak acid baths. Moreover, it stands chroming very well.

Your attention is also called to POLAR GREY GREENISH. Similar in properties to Polar Grey, it is distinguished for its shade under artificial light—its greenness serving to counterbalance colors tending to turn reddish.

Both products are illustrated on page 45 of the Geigy Handbook "Dyestuffs for Wool" 300-D.

GEIGY COMPANY INC.

89-91 BARCLAY STREET — NEW YORK—NEW YORK

Sole Selling Agents in
United States and Canada
for J. R. Geigy, S.A.
Basle, Switzerland

In Great Britain
The Geigy Colour Co., Ltd.
National Buildings
Parsonage, Manchester

Boston · Providence · Toronto · Cincinnati · Philadelphia · Charlotte · Portland, Ore.

DYESTUFF MAKERS SINCE 1758 EST. 1764

OFFICIAL PUBLICATION OF THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

For Instantaneous Wetting Out Of All Fabrics

DECERESOL WETTING AGENTS

Deceresol Wetting Agents are unusually powerful surface tension depressants. At extremely low concentrations they wet out grey cotton instantaneously. In dyeing, Deceresol Wetting Agents produce thorough penetration of the dyestuff into the fibre, yielding perfectly level shades.

In the mill, Deceresol Wetting Agents save time and money in every operation—where faster wetting means better results in less time. A few of their many uses are:

1 The wetting out of grey cotton piece goods prior to caustic boiling and subsequent chlorine bleaching.

2 Wetting out grey cotton piece goods prior to peroxide bleaching.

3 Mixing with animal and vegetable oils (previously sulphonated) to form a liquid soap possessing strong detergent properties, without affecting colors when used in conjunction with sodium or hydrogen peroxide in bleaching grey cotton piece goods containing vat-dyed colored stripes.

4 Wetting out grey cotton piece goods on a mangle, making them instantaneously and uniformly absorbent, which is necessary prior to grey sanforizing.

5 Mixing with sulphonated vegetable oils for the treatment of cotton (bleached or dyed) fabrics to increase penetration prior to sanforizing.

6 Adding to the dye bath on grey cotton piece goods dyed direct from the bale to produce penetration and uniformity.

7 The preparation of raw stock cotton, yarn, and cotton piece goods prior to dyeing with all types of colors.

8 Adding to the dye bath on all types of machines and all kinds of colors where increased penetration and uniformity of shade are otherwise difficult to accomplish.

9 A dispersing agent in the dissolving of dyestuffs in order to give complete solubility and full color value.

10 The preparation of grey cotton piece goods to be printed direct from the bale.

11 An admixture to a printer's paste to give thorough penetration, greater color value, and increased fastness to soaping, especially on cotton piece goods printed direct from the bale.

12 An admixture to vat color pastes where the process calls for pigment dyeing with subsequent reduction in the fibre or fabric.

13 De-oiling, or so-called "de-gumming", of raw stock cotton that has been dyed in the presence of sulphonated vegetable or animal oils which usually interferes with the spinning qualities. This is done in the final bath after rinsing.

14 The treatment of cotton piece goods prior to shrunk finishing.

15 The treatment of cotton piece goods and the addition to starch pastes on absorbent finishes.

16 The treatment of water prior to the addition of dry starch. This insures absence of lumps, complete wetting and complete solubility on boiling.

17 Use either with or without soap in the after-soaping of cotton yarns and fabrics.

18 In "brown scouring" for obtaining better penetration of the acid and greater solubility of calcium and magnesium salts.

19 The oxidation of vat prints, for preventing over-oxidation in the Bichromate or Perborate baths, for increasing the efficiency of oxidation and for overcoming any harsh feel that may be left by Bichromate.

20 The desizing of Rayon or Acetate piece goods.

Deceresol Wetting Agents can be used in hard water as they form soluble calcium and magnesium salts.

For neutral or slightly acid and alkaline solutions, use Deceresol OT; for strongly acid or alkaline solutions, Deceresol OS is recommended.

Write to nearest district office for further information.

89 Broad Street,
Boston, Mass.

620 So. Delaware Avenue,
Philadelphia, Pa.

20 North Wacker Drive,
Chicago, Illinois

822 West Morehead Street,
Charlotte, North Carolina

* Trade-Mark

AMERICAN CYANAMID & CHEMICAL CORPORATION

30 ROCKEFELLER PLAZA • NEW YORK, N. Y.

American Dyestuff Reporter, Vol. 27, No. 4, February 21, 1938. Published every other Monday, Copyright, 1938, by Howes Publishing Co., 440 4th Ave., New York, N. Y. Domestic subscription, $5.00; Canadian, $6.00; foreign, $6.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y. Post Office, under the act of March 3, 1879.

A. P. HOWES
Publisher

M. D. REESER
Advertising Manager

AMERICAN DYESTUFF REPORTER

LOUIS A. OLNEY
Directing Editor

NORMAN A. JOHNSON
Managing Editor

Copyrighted 1938 by Howes Publishing Co.

DEVOTED TO THE INTERESTS OF TEXTILE CHEMISTRY
• BLEACHING • DYEING • FINISHING • PRINTING •
AND THE NECESSARY MECHANICAL EQUIPMENT

"Circulated Everywhere Textiles Are Processed"

Subscription Price: $5.00 per year; Canadian, $6.00; Foreign, $6.00. Fifty cents per copy

VOLUME 27 | FEBRUARY 21, 1938 | NUMBER 4

CONTENTS OF THIS ISSUE

Contents of previous issues can be found by consulting the Industrial Arts Index at your library

General

The Problems of Rancidity in Fixed Oils Used for the Finishing of Textile Fabrics 89
Kenneth L. Dorman

Physical and Chemical Textile Testing—VI 109
John H. Skinkle

Trade Notes—New Products 115

Proceedings of American Association of Textile Chemists and Colorists

Calendar of Coming Events P93

Seventeenth Annual Meeting
Detergents and Their Application to the Textile Industry P94
J. B. Crowe

Standard Specifications and Methods of Physical Testing of Textile Materials P97
R. H. Adams

Research and Control Laboratories Abroad P100
P. H. Collier

Lacquer Printing on Silk and Rayons P103
C. Frey

Applicants for Membership P106

Meeting, Lowell Textile Institute Student Section ... P107

Meeting, Mid-West Section P107

Meeting, Philadelphia Textile School Student Section P107

Meeting, New York Section P108

Unemployment Register P108

Official Publication of the American Association of Textile Chemists and Colorists

THE OBJECTS OF THIS ASSOCIATION ARE:

"To promote increase of knowledge of the application of dyes and chemicals in the Textile Industry.

"To encourage in any practicable way research work on chemical processes and materials of importance to the Textile Industry.

"To establish for the members channels by which the interchange of professional knowledge among them may be increased."

Published Every Other Monday

HOWES PUBLISHING CO. ~ ~ 440 FOURTH AVE. ~ ~ NEW YORK

CLOSING DATE FOR ADVERTISING COPY: MONDAY PRECEDING ISSUANCE DATE

Frequently, in any industry you can name, an interested "outsider" can do a good deal to smooth out a knotty manufacturing problem. The staff of our Technical Service Division offers such assistance without obligation to users of Calco Chemical Company's dyestuffs.

This group of men has a combination of technical training and practical field experience that has made them of very tangible help on many occasions.

As manufacturers of chemical products, we naturally are familiar with many phases of their use. We are glad to learn about and help to solve any special problems that may develop in their application to your business.

Whether you are confronted with an unexpected difficulty in production—or with making a profitable reality out of a new idea—this practical help is yours for the asking. Simply write or wire our main office or nearest branch office, and a member of our staff will be sent promptly and without obligation to talk over your problems with you.

THE CALCO CHEMICAL COMPANY, INC. · BOUND BROOK, NEW JERSEY

Calco

A DIVISION OF AMERICAN CYANAMID CO.

BOSTON · PHILADELPHIA · PROVIDENCE · NEW YORK · CHARLOTTE · CHICAGO · PATERSON

AMERICAN
DYESTUFF REPORTER

VOLUME 27 FEBRUARY 21, 1938 NUMBER 4

The Problem of

Rancidity in Fixed Oils

Used for the Finishing of Textile Fabrics

KENNETH L. DORMAN*

ONE of the multitude of problems confronting textile manufacturers is that of the prevention or retardation of rancidity in the oils used in the finishing of textile fabrics. To a lesser extent, perhaps, is it necessary to retard rancidity in the oils used as auxiliaries in processes previous to the final one, i.e., in scouring baths, as dyeing and printing aids, in milling and felting, where the goods are to be given rinses, washes, or similar treatments enroute to the final product. In the case of oils to be used as scours or assists, rancidity must be minimized especially if the oils are to be stored for a period of time between make-up and use, but it is not as important as when they are to be used in the final finish, for subsequent operations will remove the objectionable odors and color if developed.

It is to be remembered that in this article that the term oils applies to fats as well. Fats are of the same general composition as oils, namely glyceryl esters of various aliphatic acids (the so-called "aliphatic fatty acids"). The influencing factor between oils and fats is the temperature. All fixed oils will solidify to varying degrees if the temperature is lowered sufficiently. Palm oil in America is a solid whereas the same product in Nigeria is a liquid. If we are to call a liquid glyceride of a fatty acid an oil, and a solid glyceride a fat, we must call frozen olive oil, olive fat. To be sure, a great many fats are of animal origin and the larger proportion of what we call oils are of vegetable origin, but fats and oils should not be distinguished on these grounds for their chemical composition is similar. However, whale oil is, properly speaking, not an oil, for this is composed not of the glyceryl esters of various fatty acids, but rather the esters of divers aliphatic straight chain alcohols and fatty acids.

Rancidity and oxidation are, strictly speaking, not the same. Rancidity may be due to oxidation, whereas there may be some oxidation but no development of rancidity. In the case of boiled linseed oil, oxidization is desirable to harden the oil (dry the oil in a paint), yet, if controlled, no rancidity develops. This would be the case in paint vehicles, or in the application of linseed oil to silk goods in the manufacture of oiled silk shower curtains. Frequently rancidity accompanies oxidation and the two terms have incorrectly grown up to be synonymous.

Hilditch[1] considers rancidity to be due to several phenomena (a) Oxidation Products of an aldehydic or ketonic nature (b) Odoriferous Compounds such as short chain acids- butyric, caproic, valeric acids, and sometimes methyl nonyl ketone and its derivatives—all due, according to Hilditch, to enzymatic action, and favored by the *exclusion* of oxygen (c) Development of Free Fatty Acid. In this last respect, there seems to be an equilibrium between free fatty acid and the other constituents in an oil, depending on the nature of the oil and the physical conditions present. This can be readily checked by determining the percent free fatty acid in raw oil, removing the same by exactly saponifying and filtering, then determining the percent free fatty acid in the freshly treated oil and the treated oil which has stood for some days. It will be found that an "$\int$" curve results, the percent free fatty acid tapering off to a near constant after a time.

Rancidity is difficult to define or analyze exactly as there are many interlocking causes. Similarly, a product may be rancid according to some chemical test and not rancid to another. Likewise, one might call an oil definitely rancid judging from odor and appearance, yet the Kreis' phloroglucinol test be negative. Incidentally, if the Kreis test is positive, the indication that an oil is rancid may be accepted, but if the test is negative the result must be accepted with reserve. Whenever a chemical test is made to determine rancidity, the reasoning and facts behind the test must be known before much stock can be taken in the test.

An oil may be too rancid for use in the textile field, yet may find use in other finishing, as for example, leather finishing where the natural odor of the leather is greater

*Research Chemist, Pacific Mills, Print Works Division.

than that of the oil employed. Similarly, in the paint industry, oils, having pronounced odors, whether due to rancidity or not, may in certain cases be used, yet these same oils may not be suitable for textile purposes.

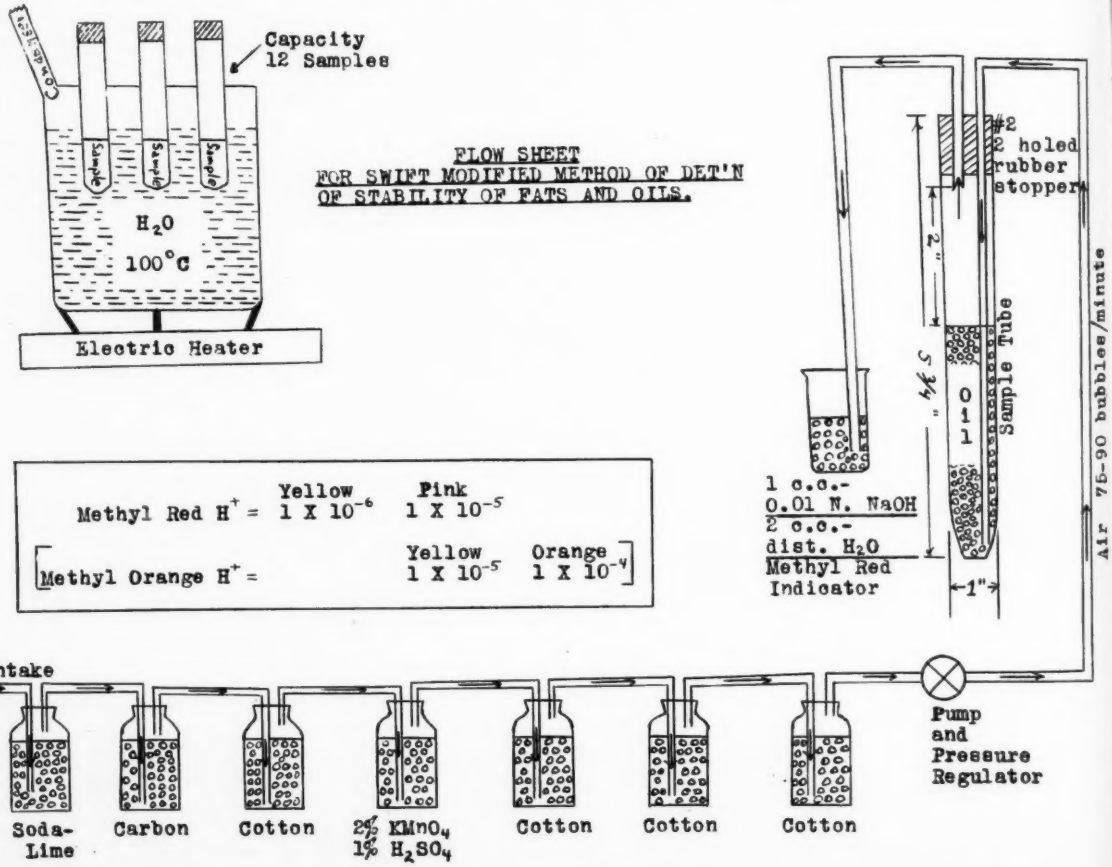
Many chemical tests for rancidity have been devised, each of which have objections and limitations of one sort or another, and none of which at the present time tells the whole story. As far as the textile industry goes, the develpment of objectionable odor and color are the two important criterion in the rancidity problem.

A useful chemical test is the Swift Test[2] using the peroxide value of an oil as an index of the rancidity. An adaptation of this test is shown in the flow sheet below. The time necessary to neutralize 1. c.c. of 0.01N. NaOH (methyl red indicator) is the induction period and is in some measure proportional to the resistance of the oil toward rancidity. From 10 to 25 grams of the oil is used as a sample. Triplicate tests are run and if good checks are obtained the average value is taken. (Note: An anemometer and a gas meter can be inserted in the line to measure the velocity and amount of air passing through the apparatus in a given time.)

Pingree's Test[3] for susceptibility of finishing compounds to oxidation is also very useful in connection with other tests. The disadvantage with this is the time needed to complete the test.

Consideration must be given to the various conditions under which the finished cloth is to be stored. Cloth stored at Nome, Alaska, may not give disagreeable odors or discolorations, whereas cloth of the same lot when stored at Salt Lake City or Mexico City may "go bad." The textile chemist must use his ingenuity in devising laboratory tests that approximate those in actual practice. Odors developing from finishing oil rancidity may go undetected in the case of one roll in a warehouse but if several score rolls are stored together the odor may be extremely evident and the goods returned to the manufacturer.

As has been pointed out above, rancidity in oils may be due to several causes. Lewkowitsch[4] says that the primary cause is the formation of free fatty acids. However, it is stated that rancidity must not be considered as coterminous with acidity. Experience has shown that it is usually desirable to pick oils that are low in free fatty acids for use in finishing work on textiles. Yet it is rumored that in the trade raw oils are being sulfonated to give finishing compounds for textile fabrics, the theory being that sulfonation destroys most of the deleterious effects the free fatty acids confer. The author has found that sulfonation does destroy some of the unwanted results of free fatty acids in raw oils, in certain oils and under certain conditions, but is not convinced of the theory in toto. In addition, in the crude oil are mucilaginous substances which are not desirable, as well as



enzymic substances, some of which may act as auto-accelerators of oxidation and/or rancidity. These enzymes do induce hydrolysis in many instances, breaking down the finishing oils, and probably acting on other ingredients in the finish, as for example, starches. Moisture also helps to further hydrolysis and rancidity although this does not usually act alone. moisture and rather high temperature are especially effective. Certain bacteria tend to promote rancidity. It can be easily shown that acrolein or acrylic aldehyde results from the pyrolysis or thermal decomposition of oils. This is a compound of extremely irritating odor and usually dark colored. If the temperature of tenter chambers, or calenders, or drying rolls be too high it may be expected that some pyrolysis of fatty compounds in the finish might occur, with the liberation of odoriferous products, and possibly starting the oil on the road to rancidity on the fiber.

Solid oils (fats) are less liable to rancidity than are liquid oils. This is partly due to the method of manufacture—the solids tend less to pick up foreign material than liquids, and the former are more easily rid of foreign matter—and partly because with liquid oils there is more of a front afforded to the agencies tending to turn the oil rancid, i.e., greater surface area is obtained with liquids than with solids. It has been stated[5] that heavy metals and their salts catalyze or accelerate the oxidation of oils, especially iron, and further, organically combined iron, e.g., haematin. Tin is considered the least objectionable towards promoting rancidity. On the contrary, tin napthenate[6] is given as an anti-oxidant for oils and waxes. It is also interesting to note as an aside, that aluminium and cobalt napthenates are used to promote drying in drying oils in cases as in paints, thereby setting up another rancidity problem if we accept the fact that certain metals catalyze oxidation and possibly rancidity.

The crude or raw oils contain in their make-up certain anti-oxidants which are formed by Nature. Some attempts have been made to isolate these anti-oxidants. Some investigators consider them to be sterols[7]—for example, sitosterol in palm oil. During distillation and refining of these crude oils, these agencies are removed or rendered largely inactive. However certain enzymes making for rancidity may or may not be removed—in fact in many cases are not. To illustrate, castor oil when only partially refined still contains enough enzymes so that it can be used as a malt in converting sizes to sugars in malting cloth, as was formerly done.

When deliberately inserted materials of anti-oxidant or inhibitory nature are employed, the period during which the oil remains latent, absorbing little or no oxygen, is lengthened. This period is called the induction period of the oil under question. This induction period may be 12 hours, 2 weeks, 6 months, depending on the nature of the oil, nature of inhibitor, and conditions prevailing. However, it must be emphasized that while it may be variable in length, nevertheless it does reach an end, after which the oil takes up oxygen in increasing amounts until approaching the point where all the oxygen that the oil can take up under the given conditions, when a tapering off is noticed, gradually then absorbing the small remainder (comparatively) of oxygen that it can to the maximum critical absorption point. During the induction period, the deliberately inserted inhibitor may be used up, after which, as explained above, full oxidation starts and is self-catalytic.

It has been known for some time, and confirmed by many, that inhibitors or oxidation and rancidity work better at lower temperatures in the main. In picking an inhibitor, study must be made of the oil with which it is to be used, the temperature range over which it is desired to protect the oil, and the nature of the inhibitor desired. If, for example, bacterial rancidity is to be prevented or retarded, one type of inhibitor (e.g. formaldehyde, cresylic acid, phenols) is better than all others as this inhibitor destroys or diminshes the bacterial content to nil. If rancidity due to atmospheric and/or catalytic oxidation is to be retarded, another type of inhibitor (e.g. propenyl methyl guaethol, $SnCl_2$, unsaturated polybasic acids as maleic or succinic) is used. Whenever there is an oxidation there must be a reduction, therefore if the oil is to be kept unoxidized (reduced), the anti-oxidant must be oxidized. Thus it is necessary to pick an anti-oxidant that is itself oxidized over a comparatively long period of time so that it is not immediately rendered incapable of doing the work for which it is put in the oil. Similarly, it is well to choose an anti-oxidant that will oxidize (or rather be oxidized) at about the same rate at which the oil tends pick up oxygen, thereby the oxygen which the oil absorbs is, so to speak, transferred to the anti-oxygenic compound inserted. In the case of propenyl methyl gauethol, the propenyl side chain is unsaturated and can be oxidized, yet is so situated that it oxidizes slowly, and in addition, as a phenyl ester on the other positions, possesses some phenolic characteristics which are beneficial to preventing any bacterial rancidity. Maleic acid is often used in edible oils as an anti-oxidant as it is said to be non-toxic. Vegetable lecithin is used in certain edible oils as an inhibitor.

From two independent sources[8, 9], rancidity is said to be checked by the use of green wrappings, cutting out that part of the spectrum between 4900 and 5800 Angstroms. It is also stated[10] that the oxidation of peanut oil at 160 degrees is retarded by incorporating 1 part of Malachite Green per 100 parts of oil. Inasmuch as Lewkowitsch[11] claims that ultra violet light aids hydrolysis it seems to the author that an investigation of the effect of violet wrappings towards preventing or retarding rancidity is worth further study.

Bailey[12] makes two claims in his discussion of oxidation and inhibitory influences. The first is that the more unsaturated oils oxidize more rapidly than the less unsaturated. This appears true to the author. The second is that ricinoleic acid, having one double bond and one hydroxy group, is oxidized much more slowly than oleic acid, having one double bond and no hydroxy group, while linoleic acid, having two double bonds and no hydroxy group, is

oxidized the fastest of these three under consideration. The theory is that the hydroxy group of ricinoleic acid confers protection on it towards rancidity and oxidation. However, in textile practice, castor oil, or its sulfonate, used as finishing oils or softeners, develops more objectionable odors than does olive oil or its sulfonate used for the same purpose. Pingree[13] confirms the author's hypothesis in that an increased tendency to oxidize was found in fatty acids containing a hydroxyl group. This discrepancy seems in need of a further check-up.

The following is a list of inhibitors used for preventing divers types of rancidity in finishing oils and soaps, having been collected from sundry sources. Nature of the oil-drying, semi drying, non drying, crude or refined, sulfonated or unsulfonated; temperature range—low, medium, high, or all; nature of rancidity to be inhibited—bacterial, enzymic, oxygenic, or combinations; processes in which the oil is to be employed; conditions which will be met—in storage of the oil before and after applying to the fabric; mixtures in which the oil is to be an ingredient; the effect of the inserted inhibitor compound on the oil, on compounds which it might come in contact with, on the fabric itself;—all play a part in the choice of the rancidity inhibitor compound. Each and all inhibitors must be accepted as under question until confirmed by experimental work in the particular case under consideration.

As anti-oxidants:

Phenols—ortho and para phenols are effective, meta phenols are of no value

Phenol	Phloroglucinol (?)
Resorcinol	Guaiacol
Pyrogallol	Guaiacol Carbonate
Eugenol	Guaiacol Sulfonate (K salt)
Catechol	Methyl Guaethol
Cresols	Propenyl Methyl Guaethol
Xylenols (?)	Hydroquinone
Carvacrol	Tannin (contain large amount of phenols—)
Thymol	

Napthols—

a—Napthol	*b*—Napthol

Aminophenols—usually very effective

p—Hydroxy Diphenyl	*p*—Hydroxy Diphenyl Amine

Amines—

Diphenyl Amine	*b*—Napthylamine
Aniline	Dimethylanilines
a—Napthylamine (better than beta)	Hydroxylamine

Acids—(Unsaturated dibasic acids are often effective)

Malonic	Citric—or Na salt
Maleic—or anhydride (only good when oils are fairly dry)	Succinic—or anhydride
	Acetic and Glycollic (for linseed oil)
Oxalic	Benzoic—or Na salt
Tartaric	Salicylic

Amino Acids—

p—Hydroxy Phenyl Alanine (ethyl ester for edible oils)[14]	Glycine[13]
	Proline[12]
	Alanine

Basic Aromatic Nitrogen Compounds—(for certain purposes only, as these may react pro-oxygenic in some cases)

Methyl Anilines	Quinoline
Pyridine	Quinaldine

Others—

Stannous Chloride	Vanillin
Sodium Silicate	Diphenyl Guanidine
Sodium Hydrosulfite	Urea (?)
Vegetable Lecithin — for edible oils	Unsymmetrical Diphenyl Hydrazine
Sterols (?)	Malachite Green (see discussion above)
Safrole	
Menthol	Poplar Buds (contain Saligenin)
Inorganic Bases	
Ethyl Xanthogenamide — for linseed oil	Gum Benzoin (contain Vanillin)

As Germicides or Antiseptics—

N—Chloro derivatives of sulfonamides (Chloramine T) (Aktivin S)	Na Benzoate
	Formaldehyde
	Cresylic Acid
o-Phenol Sulfonic Acid—from direct sulfonation of phenol (Aseptol)	Phenol
	Nitrobenzene (Oil of Myrbane)

BIBLIOGRAPHY

[1]Hilditch "Fats and Waxes" pps. 276-281.

[2]A. E. King, H. L. Roschen, W. H. Irwin, Swift Laboratories, "An Accelerated Stability Test Using Peroxide Value as an Index". Reprint from "Oil and Soap", June 1933, Vol. X, No. 6, pp. 105-109.

[3]Pingree, "American Dyestuff Reporter" Vol. 26, No. 14.

[4]Lewkowitsch, "Chemical Technology of Oils, Fats, and Waxes" 5th Edition, Vol. 1, p. 51.

[5]Pingree, "American Dyestuff Reporter", Vol, 26, No. 14.

[6]"Chemical Formulary", Vol. 1, p. 360.

[7]Bailey, "Retardation of Chemical Reactions", Chap. on Fats and Oils.

[8]"Oil, Paint, and Drug Reporter", Vol. 132, No. 19.

[9]Bailey, "Retardation of Chemical Reactions", Chap. on Fats and Oils.

[10]Bailey, "Retardation of Chemical Reactions", Chap. on Fats and Oils.

[11]Lewkowitsch, Chemical Technology of Oils, Fats, and Waxes 5th Edition, Vol. 1, p. 47.

[12]Bailey, "Retardation of Chemical Reactions".

[13]Pingree, "American Dyestuff Reporter", Vol. 26, No. 14.

[14]F. C. Whitmore, "Organic Chemistry", 1937 ed.

PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

FEBRUARY 21, 1938

Officers of the Association

ALBAN EAVENSON, *President*
Eavenson & Levering Co., Camden, N. J.

DUNCAN FERGUSON—ARTHUR R. THOMPSON, JR., *Vice-Presidents*

WILLIAM R. MOORHOUSE, *Treasurer*
National Aniline & Chemical Co., Boston, Mass.

HAROLD C. CHAPIN, *Secretary*
Lowell Textile Institute, Lowell, Mass.

LOUIS A. OLNEY
President Emeritus and Chairman of the Research Committee
Lowell Textile Institute, Lowell, Mass.

Councilors-at-Large

BERKELEY L. HATHORNE
G. R. KREMERS
WALTER M. SCOTT
HAROLD M. CHASE
ARTHUR E. HIRST
HAROLD DE WITT SMITH

Councilors Representing Sections

BEN VERITY (Rhode Island)
HANS MEYER (New York)
ROLAND E. DERBY (N. New England)
C. A. JONES (South Eastern)
R. M. RITTER (Philadelphia)
B. C. BLOWNEY, (Midwest)
HOMER WHELCHEL (South Central)
THOMAS R. SMITH (Piedmont)

Local Sections and Their Officers

Northern New England Section
Carl Z. Draves, Chairman, Ludlow Mfg. & Sales Co., Ludlow, Mass.
Jonn N. Dalton, Secretary, Pacific Mills, Worsted Division, Lawrence, Mass.

Rhode Island Section
Richard Haworth, Chairman, 25 Fountain St., Providence, R. I.
Raymond A. Pingree, Secretary, U. S. Finishing Co., Norwich, Conn.

New York Section
George L. Baxter, Chairman, Bradford Dyeing Association, 40 Worth St., New York, N. Y.
P. J. Kennedy, Secretary, E. I. duPont de Nemours & Co., Inc. 61 Thomas St., New York, N. Y.

Philadelphia Section
Herbert S. Travis, Chairman, Rohm & Haas Co., Inc., 222 West Washington Square, Philadelphia, Pa.
Paul L. Speakman, 1506 Delaware Ave., Wilmington, Del.

Piedmont Section
Raphael E. Rupp, Chairman, Pacific Mills, Lyman, S. C.
J. W. Ivey, Secretary, Mathieson Alkali Works, Inc., Charlotte, N. C.

South Central Section
Nestor Grotelueschen, Chairman, Magnet Mills, Clinton, Tenn.
W. S. McNab, Secretary, Quaker City Chemical Co., Knoxville, Tenn.

Midwest Section
Edward J. Siegrist, Chairman, Holeproof Hosiery Co., Milwaukee, Wis.
Herbert W. Tetzlaff, Secretary, Geigy Co., Inc., Milwaukee, Wis.

South-Eastern Section
Robert W. Philip, Chairman, Editor, "Cotton," Atlanta, Ga.
Alfred R. Macormac, Secretary, Alabama Polytechnic Institute, Auburn, Ala.

Lowell Textile Institute Student Section
Herman T. Buckley, Chairman; Robert A. Lemieux, Secretary.

North Carolina State College Student Section
J. E. Spainhour, Chairman; J. A. Holder, Secretary.

Philadelphia Textile School Student Section
Wayne F. Fry, Chairman; Robert Roecker, Secretary

Members should notify **Secretary** immediately of all address changes

CALENDAR OF COMING EVENTS

Meeting, New York Section, Swiss Chalet, Rochelle Park, N. J., February 25, 1938.

Meeting, Philadelphia Section, Penn A. C., Philadelphia, March 4, 1938.

Meeting, Council, National Bureau of Standards, Washington, D. C., 9:30 A.M., April 29, 1938. Research Committee will meet in the afternoon of the same day.

Meeting, Southeastern Section, Hotel Dempsey, Macon, Ga., April 23, 1938.

LAPEL BUTTONS

A new supply of lapel buttons in 10 Kt. gold, bearing the seal of the Association, will be ready about March 1st. Orders from members in good standing, accompanied by price of $1.50, may be addressed to the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. Please make checks payable to "Secretary, A.A.T.C.C."

Detergents

and their Application to the Textile Industry*

J. B. CROWE†

DETERGENTS cover a wider field than many people think, including as they do both soap and alkali. In discussing "Detergents and Their Application to the Textile Industry," we will confine ourselves to soap.

Soaps are divided into three classes:

a. Soluble Soaps.

b. Insoluble or metallic soaps.

These soaps are usually troublemakers, and will be referred to only insofar as they can be reduced or avoided and troubles from them minimized or eliminated.

c. Synthetic detergents or soaps.

Rather than give actual methods of applying soap to textile processes, we will consider soap from the usage angle which may stimulate you to inquire critically, "What is soap? Do they all behave alike? And if not, why not? Am I using soaps which are best suited for my processes? Should I be using synthetic detergents? and finally, Why do detergents clean?"

First, in establishing "What is soap?" most chemists define soap as a salt of a fatty acid. However, this definition is not strictly correct for our purpose, because not every salt of a fatty acid—even though a soluble salt—has the detergent, emulsifying and surface tension lowering properties, etc., which are so essential in textile processing.

Ten years ago, most textile soaps were made from basic oils and fats such as tallow, palm, olive or red oil, either alone or blended together. From the soap's analysis and fat characteristics, it has been thought that one could predict quite well how soaps should perform. Today, due to a variety of conditions, the situation has changed. For example, the war in Spain has demoralized the olive oil market; the drought and the tax which was put on imported tallow, palm oil, coconut oil, etc., have made necessary an extensive search for new oils and fats. Chemists and purchasing agents have gone to the far corners of the world—Algeria, China, Australia, South America, Hawaii, and have brought back samples of leaf, root, animal, berry, nut and bean to be studied by research chemists and developmental engineers. Some of these stocks were unsuitable for soap; others, by proper pressing, refining, distillation and modern hydrogenation processes, etc., make good soap. As a result, new names were added to palm, coconut and olive, such as babbassu, yucuhuba, soya and sesame.

It is true that the oils and fats which are used for making soap contain, in general, the same type but different proportions of solid, hard fats and liquid oils. The solid, hard fats, are mostly stearic and palmitic, occasionally some iso-oleic and myristic acids. The liquid oils are largely oleic, and varying amounts of linoleic and linolenic acids—the last two mentioned oxidize rapidly and are frequently responsible for odor, sticky feel and discoloration.

Now, if all fats and oils behave alike, it would make absolutely no difference what blend was used in making any soap. Unfortunately, oils and fats are like people—they have similar characteristics, but differ widely in their behavior.

As examples:—

1. If oils containing large amounts of linoleic and linolenic acids are used in making the soap, odor and discoloration troubles may result.
2. The efficiency of soaps made from the fatty acids present in oils and fats is dependent to a great extent upon the operating temperature. Soaps made from hard fatty acids, such as stearic and palmitic, both of which are present to about 50 per cent in tallow and palm soaps, are insoluble and therefore worthless as soaps at low temperatures. On the other hand, fatty acids, such as lauric, of which coconut oil contains an appreciable amount, is readily soluble and a prolific sudser. However, as the temperature increases, soaps made from stearic and palmitic acids increase in solubility, detergency and soap-like properties, while soap made from lauric acid loses its sudsing power and has reduced surface tension lowering ability and other soap-like properties.
3. Soaps made from fatty acids have excellent soap-like properties if used alone under some given operating condition. When soaps made from fatty acids are blended together in certain ratios, their soap-like properties improve; yet in some other ratios, these properties may be reduced.

Therefore, even though soaps made from different blends of oils may have identical fat characterictics, this does not mean that they will necessarily produce the same results when used under textile plant operating conditions.

*Presented at Annual Meeting, Philadelphia, Pa., Dec. 4, 1937.

†Director of Textile and Laundry Research Departments, Procter and Gamble Co.

As an example, let us consider a soap having the following fat characteristics:—Titer 20.4; Iodine Value 84.2; Sap. No. 202.0. With the exception of the saponification value which is slightly high, these characteristics match olive fatty acids closely. However, such fat characteristics could likewise apply to a blend consisting of 20-25 per cent palm oil, 50 per cent red oil, 20-25 per cent sesame—or to an inconceivable number of other blends of oils and fats. But the question is, "Will soaps made from all these blends work the same in textile mills considering solubility, sudsing power, scouring efficiency, surface tension lowering ability, rinsibility, and protection against odor troubles and discoloration of the fabrics?" They decidedly will not! The same holds true of high titered soaps whose fat characteristics have been duplicated.

Even anhydrous or real soap is not a sure guide as to processing value of a soap. Some soaps that analyze 92 per cent real soap will not be as efficient as those which analyze 88 per cent real soap. This also goes back to the ratio and type of fatty acids present in the soap. Whereas real soap is an indication of the amount of soap present, it is not always a true criterion of the soap's efficiency.

Then, too, impurities may be present in the oil stocks and not be removed in the course of manufacture. Some impurities are inert; others accelerate rancidity development. Since, it is impossible to rinse out all the soap in processing, if a soap does contain impurities, it may turn rancid resulting in objectionable odors and discoloration of the fabric. Therefore, impurities, too, are dangerous when left in a soap.

By this time, you might have formed the impression that there is no true guide as to what kind of soap to use. Nevertheless, the picture is not as hopeless as it seems. Research work has been carried on investigating such things as methods of refining to eliminate impurities in soap stocks, to protect the soap against rancidity troubles and to select oils which can be blended together and in correct ratios to give the best results.

Therefore, when selecting a soap for a textile process, consider these points:—

First—Do not use soap made from unprocessed oils or fats containing appreciable quantities of fatty acids like linoleic or lenolenic, regardless of the soap's detergent efficiency.

Second—Since processing temperature plays a big part in determining the value of a detergent, to get best results use a soap that performs most efficiently at the operating temperature. This choice, of course, is tied up closely with selecting a soap made from oils and fats so blended as to have the correct ratio of fatty acids. This produces a soap that gives the best results under your particular conditions.

In view of the wide range of conditions met with in mills, there will probably never be any one soap which is outstandingly superior for each and every textile process. By the same token, probably none of us will see the day when all operators agree that one type of soap will do all jobs equally well. Nevertheless, the swing to the lower titered soaps for an increasing number of processes is of decided importance. When made from carefully selected and properly blended oils, low titered soaps have unique, desirable characteristics which make them suited for the bulk of textile processing. Operators have demanded soaps with greater solubility and rinsibility, etc. And the logical answer has been low titered soaps. Because these soaps contain a far greater proportion of liquid oils than do the high titer soaps, they have the following advantages:

1. Greater solubility, making it possible to prepare more concentrated solutions which remain fluid even at low temperatures and do not gel like higher titered soaps such as palm and tallow. Greater solubility can be translated into a more efficient use of soap by the installation of a circulating soap system to bring the soap to fulling mills, washers, and soapers, etc., from a central dispensing system.
2. Faster rinsibility and at lower temperatures.
3. Greater mildness of action, because of the lower degree of hydrolysis. This is particularly important in processing synthetic and animal fibers.
4. More stable fatty acid emulsions with the added protection against oily deposits on fabrics.
5. More finely dispersed hard water soap curds, thus tending to prevent trouble from odor, spots, streaks, etc.

However, it has long been recognized that even the best of soaps have some serious drawbacks. The most outstanding of these has been (a) the decomposition of soap in an acid solution and (b) soap's reactivity with calcium (lime) and magnesium salts in hard water to form sticky, hard water soap curds. These lime soaps have no detergent action, attach themselves to fabrics and cause odor, blotches, streaks, dull colors, and many other difficulties. These disadvantages led to the development and the now accepted use of the synthetic detergents such as the fatty alcohol sulfates.

Synthetic detergents are considered a recent discovery. This is not accurate for as early as 1913, Reychler reported that cetyl sulfonic acid and sodium cetyl sulfonate possessed soap properties. During the World War, when Germany was so short of fats, Willstätter discovered perhydro naphthyl methane benzene carboxylic acid sodium salt, having hydrogenated rings, possessed soap-like properties. In England in 1923, Adam found that cetyl benzene sulfonic acids are soap-like and make soap gels, although the sodium salts are non-soap like. In Russia a different type of ring compound—a naphthenic acid—which has long been used and although possessing a bad odor, is not considered too objectionable.

This brief historical background shows that long before the influx of synthetic detergents, which started around 1930, many substances were known to research chemists.

These products were of much theoretical interest, but were disregarded for the most part, from a practical standpoint.

This does not mean that mills were not interested in using products to eliminate processing difficulties resulting from the inherent properties of soap nor that they failed to realize the origin of their troubles. Obviously, this was not the case. Mills found relief, in some instances, by using sulfated (or sulfonated) oils, obtained by introducing a sulfonic acid group into the fatty acid. However, it was soon realized that until the polar group was modified by eliminating the COOH radical, troubles would continue although probably not to the same extent.

This stimulated intensive research, and resulted in the issuance of thousands of patents covering synthetic detergents, some of which are good; some, without merit. Most of the new synthetic detergents are sulfates or sulfonates which, incidentally, have been produced by chemists who utilized almost every known method to link the SO_3H group with the fatty group. In view of the excellent abstract on the composition and properties of newer synthetic detergents, wetting and emulsifying agents which appeared in the September 20th issue of the DYESTUFF REPORTER, this phase will not be discussed except to mention that investigators have produced soap-like products by eliminating the COOH radical.

While soaps have certain disadvantages, the synthetic soaps, too, have their limitations. Insofar as general detergency is concerned, soap is still supreme except for some applications. For example, in scouring high shrinkage, high grease content raw wool, soap still does the better job, except under particular conditions, either of an operating or material nature, when it may be advantageous to use synthetic detergents,—alone or along with soap. For light scouring jobs such as backwashing tops, etc., the synthetic products are superior to soap considering all angles.

Where special effects are required, such as unfelted surfaces on worsteds which should be scoured and removed from the washer as rapidly as possible, synthetic detergents have advantages which make their use of more than passing interest to the critical mill operator.

For rayon-acetate scouring, many of the leading operators in New England, Paterson, Pennsylvania and the South have replaced soap with synthetic detergents.

The introduction of synthetic soaps opened new vistas for the textile mill operator, which were barred as long as old orthodox soap was the only product available for use. Some of these are: consolidation of two or more steps in a process; use of sea water, or untreated water for soaping prints, etc.; combination scouring and dyeing of lightly soiled fabrics even in an acid bath; and drastic reductions in rinsing time, without fear of odor troubles such as might develop when soaps are used.

You might be interested to know that some of the points which are being studied are the influence of pH, temperature, alkalies, electrolytes (such as salt), and hard water upon performance. For example, some products work better under acid than alkaline conditions, and vice versa. An increase in temperature improves detergency in many cases. Alkali frequently increases their efficiency while with other products it causes the fatty acid in the chain to split off and subsequently saponify to form soap with its attendant disadvantages. The presence of salt occasionally acts like a builder with some products, in the same way that alkali helps soap. Whereas, most people consider all these synthetic products stable to hard water—and they are to a certain extent—they do behave differently.

What the future will bring in synthetic soaps is difficult to predict. Intensive research is continually being carried on and resulting improvements are constantly being incorporated into the synthetic soaps.

Now—Why do detergents clean? Here are some of the theories, in brief, which have been propounded.

a. Hydrolysis

Hydrolysis of soap in water solution has been used to explain detergency. This theory is obviously incorrect when it is considered that some of the newer synthetic soaps, which do not hydrolyze, have detergent powers.

b. Surface Tension Lowering Ability; Interfacial Tension

The ability of soap to lower surface tension and interfacial tension has long been used as a criterion to evaluate the detergency of soap. But, there is no direct correlation between these factors and detergency. For example, alcohol and some wetting-out agents lower both surface and interfacial tension without having any significant detergent action.

c. Emulsifying Power

Laboratory methods, such as suspending lampblack in a detergent and subsequently filtering, have been tried hoping to judge the detergency of the product by evaluating its emulsifying or suspending ability. However, emulsification gives no true indication of detergent power. For example, casein in milk is a splendid emulsifier of butter fat and the water. Glue, saponin, etc., are other typical, well-known emulsifiers which, however, have little, if any, detergent power. Therefore, although emulsification is important, it is not the only factor.

d. Sudsing Power

Attempts have been made to obtain a quantitative measure of the detergent power of a product by noting suds height after dissolving a small amount of the detergent to be tested and shaking in a bottle. Obviously, sudsing is no true test of the detergent value of a product, when it is recalled that saponin, and some wetting out agents have remarkable sudsing power, but little or no detergency. Therefore, just because a detergent being tested under plant conditions lathers rapidly or sudses more profusely than another detergent in the washer, scouring bowls, etc., is no reason to disregard our scientific background and declare that product the best yet. Remember, the product

may be best, but, if it is, sudsing power is not the determining factor.

e. pH

pH, that happy sounding key-board phrase, that merely to say, almost entitles one to a seat among the mystical band of scientists, has been battered from pillar to post to explain anything which happens to everything. Various ideas have been expressed as to the proper pH for best detergency. Until the introduction of synthetic detergents, the correct pH was always on the alkaline side; some insisting on 10, 10.3, 10.5, 11.0, etc. Undoubtedly, pH, while again a contributing factor, and probably of vital importance in some textile processes such as silk degumming, cannot possibly be the sole explanation of detergency. This can be proved by two simple tests. First, scour a piece of cloth oiled with mineral oil using straight alkali of any desired pH.—Then, repeat the test using soap, or soap and alkali of the same pH. The answer is obvious. Alkali alone is helpless; soap or similar products are absolutely essential for good results.

THE PROBABLE MECHANICS OF THE CLEANING PROCESS

When soap, such as sodium oleate, is dissolved in water, there is probably in equilibrium (1) sodium ions (Na+), (2) simple oleate ions (O—), (3) hydroyl ions OH—), (4) sodium oleate molecules (NaO), (5) ionic micelles which are probably mixtures of the type (NaO)w (HO)x (O—)y, (H_2O)z, (6) acid soap (NaO)x (HO)y, and (7) neutral colloids (NaO)z. The state of equilibrium in which these various forms exist depends upon factors such as concentration, molecular weight of the soap, and temperature. It is conceivable that optimum cleaning or detergent action occurs only when the washing solution contains the proper relative proportion of colloidal and electrolytic materials.

However, the following simple reasoning may help explain detergency when conducted in a mill. The soap lowers both the surface and interfacial tension. Consequently, the surfaces of the fiber or fabric to be cleaned is wet out by the soap solution which penetrates the cloth, surrounding the individual particles of dirt and oil. Then, the combined agitation of the cloth and the scouring liquor—particularly if aided by the friction developed during the scouring operation—loosens the impurities from the fabric, which are then taken into the scouring bath, emulsified or suspended and subsequently removed from the scouring bath by the rinsing process.

Therefore, general detergency is undoubtedly the result of the combined action of various factors—(a) temperature, (b) detergent concentration, (c) surface and interfacial tension—to help in wetting out the fabric, (d) friction and mechanical action—to help loosen the impurities from the fibers, and (e) emulsification—to suspend the dirt and to prevent its redepositing on the fabric during the rinsing operation.

So, it seems a soap should not be selected merely on the basis of one or two of its qualities such as the volume of suds it produces, its wetting-out power, etc., or for that matter, its fat characteristics, or real soap content. Rather, a detergent should be selected considering—first of all—the process—the job we are going to ask the detergent to perform. Then, the detergent chosen must have composite qualities—such as sudsing, emulsification, etc., which will perform this work in the best possible manner, producing the highest quality at the lowest cost.

—— ♦ ♦ ——

Standard Specifications and Methods of

Physical Testing of Textile Materials*

R. H. ADAMS†

ANY discussion of specifications and methods of physical testing for materials, designed to explain how such specifications and methods have been written in this country, and to show their industrial significance, must be prefaced by some reference to the early developments in advancing the knowledge of engineering materials and the methods of testing these materials.

Specifications for materials are used as the basis of purchase, in the form of specified requirements of manufacture, chemical, physical and other properties, testing inspection, etc., in such detail as to insure the delivery of materials or products of the desired quality. The term "purchase specification" is a convenient designation for this type of specification. Standard methods of testing materials are essential to the preparation of standard specifications, as will be pointed out.

*Presented before meeting, Southeastern Section, October 9, 1937.

†Testing Department, Callaway Mills.

In the earlier days of industrial development, before the arts of manufacturing many of our present materials were known, the constructor had a more or less intimate knowledge of the production with which he worked and he was often associated with both their product and use. Then later many new materials were developed, with their highly specialized treatments, with difficult constructions and problems making new demands upon engineering materials followed in the wake of the introduction of steam, electricity, the automobile and the airplane, each in turn profoundly affecting industrial conditions and manufacturing.

Then, with the increasing diversity of material and the increasing severity of requirements in service, there arose the urgent need for studying the properties of the materials and their performance under varying conditions of service. When we consider these properties we are impressed with the fact that not much was known concerning them. Art and not science had been the basis of the use of materials in construction for centuries. Experimental data were few and imperfect. In the first fifty years of the last century, coincident with notable advances in pure and applied science, much progress was made in theory and the knowledge of behavior of materials under stress. The development of means for transportation served as a powerful stimulus in the investigation of materials because of need for ample security with the greater economy. Methods of testing were so imperfect, however, that progress was slow until about 1850. The improvement in commercial development of apparatus for testing made it possible to study the physical properties of materials more carefully. About the year 1870 the importance of chemical and physical tests controlling the uniformity of products was beginning to be recognized. This date marks approximately the beginning of the appreciation by industry of the important and indeed fundamental part that science and technology must assume in the working out of industrial problems, and the establishment of better and more thorough means of training men to be qualified to assume the responsibilities. As the testing of materials became more general, and records were made available for study and comparison, it became evident that tests must be made by uniform methods and placed upon a scientific basis if they were to be of the greatest usefulness. Realizing the value of exchange of information and opinions, a small group of workers in experimental engineering met at Munich, Germany, in 1882 to discuss how best to promote uniformity in methods of testing. Their meeting attracted much attention internationally and led to the formation in 1895 at Zurich, Switzerland, of the International Association for Testing Materials, having for its objects "the development and unification of standard methods of testing, the examination of technically important properties of materials of construction and other materials of practical value, and also the perfecting of apparatus used for this purpose."

ORGANIZATION OF THE AMERICAN SOCIETY FOR TESTING MATERIALS

The first concerted effort of engineers to develop the science of testing materials filled a real need in the engineering world, and its value was quickly recognized in this country. In 1898 about twenty American members of the International Association met in Philadelphia and formed an American section for the purpose of bringing the American members into closer relations among themselves and enabling them to act as a unit with respect to American interest.

Remarkable as it may seem in the light of what is now a more or less general practice, the principle of purchasing materials on a basis of specifications and subject to test was practically unknown at that time. It involved ascertaining what materials were best suited for given purposes and why; fixing the desired values of chemical and physical properties; and not least in importance, of devising methods for making acceptance tests and inspections to insure the delivery of proper materials. About 1902 the American section was incorporated as The American Society for Testing Materials, having for its objects "the promotion of knowledge of the materials of engineering and the standardization of specifications and the methods of testing."

Among the first important matter taken up by the newly organized section of The American Society for Testing Materials was the physical separation of the consumer from the production of materials previously referred to. This separation served to emphasize the need of means whereby the producer and consumer could meet upon common ground to discuss and agree upon the quality of materials for various uses and to fix upon an equitable commercial basis upon which such materials should be bought and sold. There was in existence no common language, that is, uniform methods of testing and inspection, as the condition at that time was very unsatisfactory in the exchange of materials between producers and consumers. It was considered to be an important function of the new society to serve as a means for improving these conditions.

It has taken time and education to show that in the broadest sense the best interests of producers and consumers of materials are not conflicting, and that every step towards their better reconciliation is of mutual advantage. A description of the standardization work of the American Society for Testing Materials and The American Association of Textile Chemists and Colorists, and other societies, since their organization, which, as a result of many years' experience, is now upon a stable and enduring foundation, will fairly accurately reflect the present-day status in this country of developments and use of standard specifications and methods of tests for textile materials.

The societies' membership is made up of all interested parties, and is thoroughly representative. It includes producers of raw materials and manufacturers of finished

products in the major industries such as rubber, textiles, railroad groups, shipping industry, electric companies, automobile industry, the public utilities, construction and building interests, federal, state and municipal developments, and other large users of materials, consulting engineers, architects, commercial testing laboratories and educators in the textile schools and other engineering societies, finishing plant dyers, chemists, Home Economics Departments of many of our larger universities; and from such a membership it is possible to bring to bear upon the solution of any problem on material standards the combined experience of the highest testing authorities and those who are intimately connected with production and use of materials.

When it has been determined to prepare a certain standard specification, the problem is placed in the hands of a committee representative of the various interests involved. These committees are made up of three groups: (1) producers, (2) consumers of the material or product under consideration, (3) independent experts, such as consulting engineers, educators, etc., who are neither producers nor consumers. In this way the points of view of all three groups are brought directly into contact with each other.

The standards developed by the Committee D-13, Textile Section of The American Society for Testing Materials, and listed in Book of Standards of Specifications, Tolerances, Methods of Testing, Definitions and Terms, number about twenty standards and seventeen tentative standards. These various standards cover not only methods of tests for textile materials but also tolerances within which the textile must come in order that it shall constitute a good delivery on contract.

The important physical properties of mechanical fabric textile materials are listed below according to importance of their construction and requirements:

Fiber length, tensile strength, weight, count (warp and filling), twist, regain, elongation, crimp, thickness, length and width, tear resistance, yarn friction in fabric, evenness, graphical determination, abrasion wear service, absorbability, bursting, heat transmission, porosity. The physical properties and constructions are changed according to requirements and service demanded of the materials.

Some of the important requirements of fabrics for consumer trade as suggested by the Bureau of Home Economics Department, Washington, D. C., and teachers of Home Economics in Universities are:

Style, attractive color, warmth, durability, water absorption, launderability, crease resistance, shine resistance, non-shrinkability, non-stretchability, abrasion or wear, color fastness, sizing, tear resistance, thickness of napped and pile fabrics, elasticity, slippage, perspiration, heat conductivity, covering power of fabrics and twist in yarns.

You will note from the above requirements of highly specialized fabrics, both mechanical and for consumers' trade, that the design and equipment of a laboratory should be set up to measure every physical and chemical quality of fibers, yarn and fabric, and must be equipped for this purpose with machines and appliances of highly specialized nature, as the physical testing of manufactured products is attended by special difficulties. This is due in a large part to the great variability as found in fibers used in the manufacturing of textile materials.

After we have designed and set up our laboratory, and equipped it with conditioning apparatus for a standard condition of 65 per cent relative humidity and 70° temperature, we must measure our raw materials to get at the basic qualities for spinning yarns that go into highly specialized fabrics. The preparation of samples for proper conditioning in revolving conditioning racks is very important. The samples should be properly spaced to permit complete air circulation between each sample. It is very necessary that the samples remain in the conditioning rack until each group has had sufficient time to reach its equilibrium each time before testing. The factors affecting the strength, stretch, twist, and the diameter of the yarns, both single and plied, should be thoroughly studied to obtain a clear conception of the cause of different results found in physical testing. It is highly important to know these facts before the yarns are plied and woven into fabrics which call for special treatment, as the uniformity of yarn is of great value in the weaving of mechanical fabrics, especially when fabrics are to be used for a definite purpose such as a heavy belting, filter fabrics, strainers or conveyers of liquid products. It is quite necessary to know the relative porosity or ability to permit the passage of water, oil, gas or air. For square woven hose and tire materials the pin holes of the fabric must be uniform in diameter and distance to permit the proper bonding of the rubber friction when several plies are to be used to make up a hose or tire. The same is true for yarns going into consumer fabrics.

The development of the automobile and aircraft, and the numerous types in which these machines now exist, have brought into prominence many new and very highly specialized engineering materials. The very existence of a standard is a constant invitation to experimentation and development of better raw materials to meet the requirements.

Textiles are not immune to demands of the acid test of progress, as it has been found that all textiles are within the scope of testing either as research or daily routine practice, from raw material to the finished product, whether it be cotton, wool, linen, silk or what not, so significant is this fact that many large mill groups are accurately controlling uniformity in manufacturing in every process from raw stock to finished goods by a carefully regulated test procedures and analysis of facts obtained from tensile strength tests made in the laboratory.

Research and Control

Laboratories Abroad*

P. H. COLLIER†

I AM delighted to have this opportunity to talk to you for a few minutes this evening and discuss with you some of the things which have been on my mind for the past two or three months. We are delighted to have the visitors in our city, and I hope you have enjoyed your short stay with us. I believe this is the second meeting of your association to be held in La-Grange, and I hope we can look forward to another such gathering in the future. Men, I want to confine a few remarks tonight to experiences on my recent trip to three European countries, during this past summer, the things I observed, and the impressions I received while visiting some of the outstanding industries of the world and some of the finest laboratories in the world. While they do not pertain directly to the cotton textile industry, nor to your particular phase of the cotton textile industry, they should, I think, arouse our desire to do bigger and better things. I was tremendously impressed with the amount of research work being done in all types of industry, and if our own particular industry is to be one of the leading industries, or even keep pace with other industries, I know we must think seriously about research work. With various and numerous synthetic fibers encroaching upon cotton, and with the new problems of handling and finishing, we must of necessity study the possibilities of these new mixes and blends.

I want to cover this trip again tonight in our minds and tell why the trip was made, how the arrangements were made, and some of the things which were seen. In England, France and Germany, I was permitted to see research work being carried on in laboratories, which, had it not been for arrangements made by the National Research Council, I could not possibly have seen. A word about the National Research Council, I believe, will be of interest to you. The National Research Council is an old co-operative organization, having first been established during the War between the States. The purpose of it at that time was to bring together scientific minds, scientific and technical laboratories and industries, to effectively combat the Confederate States. This organization was disbanded shortly after the War between the States and was reorganized again in 1916, during the World War. Its purpose this time was to accumulate and disseminate technical data and information, which would be of benefit to our country in the event we were drawn into the World War. In 1918, by executive order of the President of the United States, the National Research Council was established as a permanent organization. It is under the auspices of the National Academy of Sciences, and consequently enjoys the co-operation of all major scientific and technical societies in the United States.

The program of laboratories and industries to be contacted on our visit was arranged through our government with government officials of the three countries visited; otherwise, we could not have seen many of the institutions which were opened to us. If industry is to forge ahead, if new ideas are to be found and developed, it is absolutely necessary, in my opinion, for industry to recognize the important position that research departments and divisions must occupy.

I might say, here, that, while the majority of our time was consumed in visiting laboratories, some time was spent in seeing other sights of interest, particularly in Paris. Since the nature of our trip was research work, it was necessary, of course, that we do a little research work on the night life of these countries, and I must say that we found Paris way out in front of other cities. You can find in Paris some of the finest technical and scientific institutions in the world, as well as some of the hottest night clubs in the world. In order to keep our minds on our business, however, we had better leave Paris for the time being. With the purpose and nature of our trip in mind, let's board the French liner, Normandie, and pull out. This ship is, in reality, a "floating palace" with every form of amusement, with the finest and best French food, and with its smoothness, the four and one-half days, consumed in crossing, gave me a real pleasure. We landed in Southampton, England and spent approximately two weeks visiting England's outstanding industries.

I don't want this talk to be too much in the nature of a technical report on the laboratories visited, but it will be necessary to mention the many phases of work into which these laboratories delve, in order to impress you with the amount of scientific research work being done. For instance, the National Physical Labora-

*Address before meeting, Southeastern Section, October 9, 1937.

†Callaway Mills.

tory at Teddington, just outside London, you will find, is one of England's finest institutions. You will find in this laboratory some of the world's greatest scientific brains. Sir James Jeans, who ranks with Professor Einstein, Dr. Gough, who lectures to M.I.T. and other technical institutions in this country about four times a year, and many others of equal rank direct the work being done in this laboratory. To give you an idea of the type work being done, I will enumerate a few of the departments included in their set-up; Engineering of all types, Aerodynamics, Photometry, Metallurgy, Metrology, High Voltage Electricity, Physics. One of the finest equipped ship tanks is located in this laboratory, where research work is carried on in ship designing and ship propulsion. This institution compares favorably with our National Bureau of Standards. I believe that industry in England, however, takes advantage and receives more benefit from the research work done in this institution than the industries of America receive from the Bureau of Standards.

It was our privilege to visit industries of the following types, viz.; leather, wood, steel, glass, electrical, chemical and textile. The research laboratory for the cotton textile industry is located at Didsbury. In this laboratory the cotton fiber is studied from every known angle, and the technical and scientific men connected with the institution are now looking for the unknown. This laboratory is equipped with the finest testing apparatus and the finest brains obtainable. They employ 300 men on the research staff, of which number ninety men are scientists with degrees. They work long and patiently on problems pertaining to textile fibers. I am inclined to think that we in this country are not long-suffering enough, and consequently miss some good bets, which our English friends find.

In the laboratory of the Metropolitan Vickers Electrical Company will be found another 300 scientific research workers. The General Electric Company Limited of London employs in its research laboratory 500 technical men and spends well over a million dollars annually in the laboratories. This company was unique in that all new developments are worked out in their laboratory on a full production basis, before they are turned over to the factory to be carried on on a commercial basis.

The Mond Nickel Company, located in Birmingham, England, has recently completed and moved into its new laboratory building, which is the most complete institution of this kind seen on the entire trip. In discussing research work with the officials of this company, I was informed that a million dollars is set aside annually to carry on this work. I was also informed that between fifteen and sixteen million dollars clear, net profit was made by this concern last year, and that they attribute 90% of their earnings to efforts of the research division.

In the Burroughs Wellcome & Company's laboratories, it was interesting to note the extent to which these scientists went in studying problems connected with prevention of diseases. For instance, the sleeping sickness, which is spreading through the world, is caused by the tsetse fly, originally found in South Africa. Many years and hundreds of thousands of dollars have been spent by this company in studying the conditions in South Africa and accumulating data, looking towards the eradication of the causes of this disease. This is being mentioned merely to give you an idea to what extent industry is going into scientific problems.

The Cavendish Laboratories at Cambridge University were visited. We found here laboratories in which men from all over the world are studying. One department of this large scientific laboratory has been working for two years on the effects of cosmic rays. They were preparing 100 miniature balloons, equipped with delicate instruments, to be released for test flights into the stratosphere, the instruments to record every effect of the cosmic rays. These balloons were to be released in Greenland during the month of July, and I have been interested in learning the results which they obtained. This is another indication of the extent to which scientists will go to gather information for the progress of industry and for the benefit of mankind. I also visited several cotton mills in the vicinity of Manchester.

From England, we went to France, landing at Calais, and on to Paris, While the English language is our native language, little difficulty was encountered in understanding their accents and pronunciation, for instance—aluminum (alumain) Laboratory (labority). This, however, was not a circumstance to the trouble I had when we landed in France. In Paris and in the neighboring vicinity, some of the finest laboratories in the world can be found. Much time was spent in Madame Curie's laboratory, where research work on radium is being done. Madame Curie, one of the world's greatest scientists, said that it is impossible to direct research work, but that scientific research work must direct you.

We visited Pasteur's Institute, College of France, Paris School of Chemistry and Physics, National School of Arts and Measures, the French Aeronautics Laboratory, the French School of Welding, and the Locomotive Testing Bench. I will not go into detail on any of these laboratories, except to say that these laboratories and these industries are exerting every effort to find new ideas, new uses, and improved methods of handling, and that their efforts are being rewarded. Some of the interesting points seen in France were the Exposition, Versailles, Trianon Palace, Malmaison and Louvre Museum.

After spending a week or ten days in Paris, we went into Germany, and I must say that Germany impressed me profoundly with its laboratories and industries. You realize that Germany is extremely short of all of the

basic raw materials. You realize, of course, that Germany cannot buy from the outside world all of the raw materials it needs. Being faced with this situation, this country is endeavoring to overcome its short position by manufacturing the various materials needed; more so than in the other two countries visited, Germany's research laboratories and Germany's industries work closer together. For instance, the need for fibers to replace cotton being present, German laboratories are making synthetic fibers from many different products, of which they have an abundance. Germany is short on mineral oils and the by-products of oil and is, therefore, manufacturing a good grade of synthetic gasoline from coal. Numerous instances could be mentioned of this nature.

We were given a most cordial welcome into Berlin by the Verein Deutscher Ingenieure, which is the Society of German Engineers; and, incidentally, I met at this reception a railroad engineer who had previously been connected with the A.&W.P. R.R., and who had been to LaGrange, Georgia a number of times. It was our pleasure to visit the famous Krupp Works in Essen, Germany, where the big guns, which fired on Paris, during the world war, were fabricated. In the laboratories of this concern, we were shown the finest equipment in the world used in testing materials produced by this world famous steel company. While we were there, they were working on seamless boilers to withstand high pressure, formerly believed impossible. This idea was developed from their research work on cannon.

In the Brown Firth Laboratories, one of the biggest ship and armament plants in the world, we learned that this concern, while developing steel for guns in 1910, accidentally discovered stainless steel. Recently, they have been working on a steel to contain color from which it may be possible to stamp an automobile body that will require no painting.

Germany has developed a synthetic rubber, which is called "Buna", and which is proving much better than natural rubber. "Buna" tires are being used as standard equipment on vehicles. This synthetic rubber will last six times as long as natural rubber. We were told that even if Germany could have as much of the natural rubber as they wanted, they would continue to use this synthetic product.

Germany has plenty of coal, from which numerous products are being made on a commercial basis. Germany, for instance, is short on gasoline and oil and is, therefore, producing synthetic gasoline from coal. I understood that 4% of the entire country's requirements on gasoline is being produced from coal, and that by 1939 Germany will be entirely self-sustaining, as far as gasoline is concerned. We were told that the last thing in the world we should do with coal is burn it. Fuel in the future will probably be produced from garbage or grass, and coal will be used to a far better advantage.

All along our route, I had been looking forward to a visit to the I. G. Farben Industry at Ludwigshafen. This is, you know, the largest producer in the world of aniline dyes. We, here in our own industry in LaGrange, and you, in your own individual companies, have used a lot of I. G. Farben products. I had stored up a lot of questions to ask the research department of this company, but, unfortunately, I was the victim of some gas, on entering this plant, and spent the time in a hospital, which should have been spent in the laboratories. Before going into their laboratory, however, we assembled in their lecture room and had a most interesting talk for about an hour by the head of the research department. In this lecture, he pointed out the various products developed by I. G. Farben's research laboratory. These products were displayed for our inspection, and it made me wonder just how far the I. G. Farben Works would have gone had it not been for their research laboratories. It was pointed out, in this lecture, that from coal alone, 20 useful products had been developed.

I could go on, fellows, naming incident after incident, proving the worth of industrial research laboratories. However, I feel sure that you will agree with me that our industry will not keep pace with other industries, unless we think more seriously in the future than we have in the past along the lines discussed here tonight. Having seen a few of the advancements made in Europe through research work, let us now take a boat back to our own country and while en route think of America's industries, as compared with the industries we have visited. Do not think for a minute that industry in America has been asleep, while the European industries have been working. Many of America's major industries have as fine laboratories and research departments as can be found in the world. For instance, the Bell Telephone laboratories, General Electric laboratories, the laboratories of the large rubber companies, the Aluminum Company of America's laboratories and many others that I could name have been awake and have realized the importance of research work.

The thing I want to impress you with is that not only industry, as such, must be wide awake looking for new ideas, new methods and new developments, but individuals making up industries must realize that to keep up, they must keep their minds open for such development work. With the brains we have here in this room tonight concentrated on new ideas and new developments for the textile industry, I know we would go forward and take our place with other leading industries in the world. I have just read an article in "Barron's, The Financial Weekly", which was written by a member of our party. Mr. Bert White, Vice-President of the Liberty Bank of Buffalo, stated in the article that an obvious conclusion is that research is one of the best safeguards for capital

invested in industry. He further stated that when we look at a company's balance sheet and analyze its current balance, fixed assets and last quarter's earnings, we know only the story of the past, all of which may easily fall victim to a competitor's research laboratory. He further stated that investment divisions of large insurance companies have been working to determine just what the mortality rate of certain kinds of business is. The one point which they have determined is that the company that died invariably did no research work.

Lacquer Printing

on Silk and Rayons*

C. FREY†

I WILL divide my talk into seven parts as follows:

First: Metallic prints with lacquer and bronze powders on the multiple printing machine.

Second: Colored pigmented lacquers on the multiple printing machine.

Third: Deluster lacquer printing on satins, white upon white, or tinted colors also on the multiple printing machine.

Fourth: Lacquer printing with flock stencil machine.

Fifth: Coating pure silk with lacquer to obtain taffeta rustle effect.

Sixth: Printing on oiled silks.

Seventh: General notes on lacquer printing.

1. METALLIC PRINTS WITH LACQUER AND BRONZE POWDERS

After many months, with the cooperation of some of your members, we developed a lacquer base which when mixed with special bronze powders gives bright lusters, almost non-tarnishing, with exceptionally good adhesion and flexibility. Good results were not all due to the lacquer. It was very important to have proper adjustments made on the machine.

Some firms are printing lacquer on the Reid Barton Machine and feeding lacquer from the feeder box if the runs are large enough. If the runs are small, lacquer can be fed from the doctor blade and using "Weeper Doctor" back of the feeder. This is advisable when using the feeder box method. The reason is, that if any of the material gets past the first doctor, the second will clean it off before it has a chance to become semi-dry and carry off on the fabric and stain.

It is very important that proper pressure is used in lacquer printing. Some colors require very light set and others require a tight set in order to pull out the lacquer from the engraving. These adjustments apply not only to metallic prints but to all lacquer color printing. The printed material should be run into a dry box or heated tunnel with the same heat as used in regular printing. If the dry box is used, it is advisable that the door of the heated box be left open and sufficient ventilation arranged so that the solvent vapors can escape. All machines should be grounded at several places to discharge static electricity which avoids sparking that may ignite the vapors.

2. COLORED PIGMENTED LACQUER FINISHES

Pigmented colored lacquers are specially prepared and, in most cases, are ready to apply, with exceptions of a little thinning to suit the depth of the rolls, spreading and also sticking in. In some cases it may be necessary to add small amounts of plasticizer to give a little more flexibility. In adding plasticizer, one must be very careful not to get too much into the mix or the finish may become sticky or scuff off very easily.

Pigments generally used in lacquer are very fast to light. When printing with pigmented colors it is also necessary to run the fabric through the heated dry box or tunnels.

There is some colored lacquer printing done with dyes, but the colors are limited, as few fast colors are available.

3. DELUSTER PRINTING ON SATINS

This is a water-resisting deluster finish that will also take dry cleaning. It is used on white, pink, or other pastel shades of satin.

If one wants to deluster a white satin, all that is necessary is to use the white base "as is." If you want to print colored tints, it is necessary to add a small amount of a suitable pigmented tinting lacquer to the desired shade. If dark, dense colors are wanted, it is necessary to use a special deluster lacquer made to match the shade desired. The deluster lacquers are semi-transparent and will not cover over contrasting colors unless you desire this effect.

They can be run on a multiple machine as well as a lacquer machine and should also go through the dry box or tunnel.

*Presented at meeting, New York Section, October 22, 1937.

†Maas & Waldstein.

4. METHOD OF STENCIL OR FLOCK PRINTING WITH LACQUER

This can also be considered a form of application printing. A perforated copper stencil belt is used through which the lacquer is forced with a doctor blade on to the fabric. Due to the heavy deposit it must be festooned to be sure it is dry.

For this method of application special lacquers have to be used. The lacquer must have the following qualities:

1. Must print.
2. The print must stay raised.
3. Not stick in the stencil.
4. Not penetrate too deeply into the fabric.
5. Dry by the time the fabric reaches the end of the festoon.
6. Have adhesion.
7. Have flexibility.

Metallic prints and many colors can be done this way. The designs by this method are limited to dots, triangles and small lines.

5. TAFFETA RUSTLE FINISH

This is another special lacquer made to produce a rustle or taffeta effect. It is a clear very viscous lacquer plasticised to give the desired effect after drying.

During the application of the lacquer the fabric is drawn taut over a starch-backing machine or an artificial-leather machine. The lacquer is poured behind the doctor blade and the fabric is drawn under the tight doctor blade with as great a speed as possible. The speed and pressure on the doctor blade controls the amount of lacquer deposited.

Some firms use two doctor blades, the second one being used to spread the lacquer and give a more even or uniform coating. The fabric is moved into a heated box to accelerate the drying. Quick drying keeps the lacquer on the surface which is desirable. It is also important to run the silk over a button breaker to give better handling.

Various taffeta effects are obtained by adjusting the amount of lacquer deposited.

6. PRINTING ON OILED SILKS

There is another lacquer which is used for water-resisting shower curtains. The lacquer is applied on two sides, with the same machine as taffeta is made.

7. GENERAL NOTES ON LACQUER PRINTING

Lacquer printing is not new. It was done by Lyons Piece Dye Works for a number of years as novelty printing. Lacquer printing is a quick method. You print direct and run the material through a heated tunnel and then roll it up at the other end of the tunnel. No steaming or washing is necessary.

Lacquer prints are not as permanent as fixed dye prints. Lacquer printing if properly formulated will stand dry cleaning very well but will not resist washing as well as the reduced dye printing. It will take diluted soap rinsing without much difficulty.

In the past few years there have been rapid strides made in application of lacquer printing on rayon, silks and acetate rayons. This progress was made in spite of greater obstacles that have to be overcome than in discharge printing. In discharge printing the yarn is prepared so that it is free from any impurities in order to get even penetration with the dye. In printing direct dye and then having the color reduced on the fabric it gives a very permanent effect due to the chemical change. Printers are expecting the same results with lacquers that they are getting with reduced or fixed colors. Up to the present time this has not been possible as the best we have been able to obtain is a surface adhesion.

A general impression exists that you can take finished goods that are unsaleable off the jobber's shelf and turn it over to a lacquer printer for gold or other lacquer printing. The object being to convert the goods on hand into saleable merchandise.

In some cases this is possible, in others trouble immediately develops. When difficulties arise it is caused by the sizing and finishing operation that may have been used on the particular lot of cloth. As you know these sizings which are part of the finishing operation may consist of one or a combination of water soluble gums, caseins, glues, glycerine, soaps, sulfonated oils, mineral oils, and other troublesome fillers insofar as adhesion to lacquer is concerned. The lacquer printer should carefully check the cloth in question before he accepts it for production or he may get into serious difficulty.

Most lacquer printing is done on special machinery built for this purpose. Some of these machines are known as the Tenny Hoffman and the Werner machine which are one color print machines. There are others which we are not familiar with. These machines are fed from the doctor blade and then the material is run through a heated dryer box and rolled up after leaving the dryer. This method of printing is very quick. In some instances it is advisable to have special engraved rolls to get the proper results.

Lacquers for printing are made of various celluloses, plasticizers, resins compounded in solvents so they can be printed on with the machine without sticking on the rolls. Most of the colored lacquers are formulated with cellulose compounds with organic and inorganic pigments. Very few dyes are used.

We believe that if the dye manufacturers and lacquer manufacturers got together there could be more accomplished. Up to the present we haven't gotten very far. But I think that lacquer printing, insofar as the novelty end of it is concerned, is here to stay. As long as the styles are here, and I think they will be willing to work with us. We know that the existing lacquers are not quite suitable for the general run of dyes. I believe that we will have to get special dyes for best results. I have

some samples here which you can look at after we get through.

We take our bronzes and we wet them in a thinner and get them dispersed very smoothly. By doing that, we get away from the grit that you get if you throw the dry powder into the heavy body lacquer. We let it rest for half an hour or an hour, before we print it. We find by letting it stand a while, it seems to help matters.

As I said before, we have agents in there to prevent tarnishing, and we also have synthetic resins to give us adhesion and good flexibility.

On your machines it is very important to watch pressures. You can get too much pressure on a machine, and, by doing that, you won't pull it out but you will keep it in there. You have got to get that happy medium whereby, when your lacquer strikes your fabric, you pull it out. The idea is to get enough pressure there to get your design. Of course, if you don't get enough pressure, you won't get sharpness; and if you get too much pressure, you don't get any material at all.

One thing that is very important; if you are using your regular drying box on the second floor, and running lacquer, it is advisable to keep that door open, because of the vapors. If you get too much vapor in there, you are apt to blow the thing apart. You want to get as much air in there as you can.

Another thing: Ground your machines, not just in one spot, but in as many places as you can. If you don't you are apt to get an accumulation of static that will cause an explosion or fire from the vapors in the room.

If you find the finish is a little hard—some goods absorb more than others, and if you get more absorption, you have to get a harder finish—be careful you don't get too much plasticizer in it, because if you do, you are apt to get yourself in more trouble, as it will spread and print on the other part of the goods.

When you get into pastel shades, you have to be careful to get pigments that do not fade. If you take pigments in their concentrated form, so that the light can't get through them, they are not so apt to fade. But when you bring them down to very light tints, and you get the rays of the light shining around them, they fade out very readily. So in case you ever make pastel shades, be sure and ask your lacquer man to supply pigments that will not fade out on extreme reduction.

Lacquer printing is done identically the same as metallics, but with this exception—and in fact that applies to every color with the exception of the metallics—if you should find that it dries a little hard, it is advisable to run your goods over a buttonbreaker. A lot of people are demanding a "hand" the same as you get with the regular dye. It is impossible to do that. And, after all, when you dye, with your method of dyeing, you wash off your plates.

In lacquer printing, we have to use a binder and, therefore, we have to be very careful not to get it too heavy, which would cement the fibers and make it very hard. If run over a buttonbreaker, in most cases it will break up that cemented effect on your loom, and give you a good "hand."

And, getting back to plasticizing, we are demanding a good "hand," and there is only one way to get that, and that is by what I would call over-plasticizing. And that is where you get in trouble with marks. Also, you don't have the appearance.

We have another material here known as a de-luster finish. If I recall it properly, you term it a jacquard printing. There has been a real run on that for the last year. It consists of a semi-opaque lacquer printed over a satin effect. A beautiful contrast is obtained.

It is a finish of which you can run off many thousand yards a day. You can get a good "hand" with it on rayon, and in many instances you don't have to buttonbreak it.

We had quite a problem with acetate rayon. We finally licked it. Personally, I like acetate rayon better than I do the other two. You get better adhesion.

As mentioned before, when you make the tints, make sure you get pigments that do not fade. I have seen where people have taken colors and mixed them with white to get a pink, or whatever they wanted, and take a sample and print it, and find that the color was gone in an hour. But you can get colors that can be diluted very much, and will not fade out.

There is a blue and a red that we know of that we had under a Fadometer for 100 hours, and they didn't go out. So we don't have to worry about pinks and blues. They do make a pigmented de-luster lacquer with a blue, or Navy. You can de-luster Navy, and have two shades of Navy. One will be dull, of course, and the other bright. There have been a lot of people trying to work with the regular transparent lacquer, and put it over a dark shade. It is not very satisfactory as it gives a dirty gray appearance.

There is a big machine run with a continuous metallic stencil or belt that is perforated. It sweeps the lacquer through, depositing it on the cloth, or fabric. It is then festooned and is dry by the time it gets to the end of the festoon. In most cases, the print must stay raised as you want raised effect in this class of work.

We had quite a lot of work this season with white over-print on dark colors.

I don't know whether some of you gentlemen have come in contact with making imitation taffeta with rayon, acetate rayon and silk. That requires a little different method, another special lacquer. The lacquer had to be made so that after the cloth dried, it would give a rustling sound.

There is one disadvantage that the lacquer printing has over regular printing. In regular printing, you prepare your fabric. You have it clean, so that you get an even dyeing. But, unfortunatly, with lacquer printing, they

take finished merchandise from the shelf, after it has been finished with various finishing compounds, send it out for lacquer printing, and expect to get adhesion. A great deal depends on how the lacquer is made, and how your finishes are made.

As I understand it, in finishing these textiles, glycerine, soaps, glues, caseins, waxes, mineral oils, and other compounds are used. In that case it is pretty hard for lacquer to give you true adhesion. After all, all you do is deposit your lacquer on the surface, and you just cement it to the fiber.

None of the materials that I mentioned are compatible with nitrocellulose.

I believe that the adhesion today is far superior to what it was in the early days, and it is due to nothing more than knowing more about lacquers, and how to use them. So, therefore, if you get poor adhesion, it would be wise to investigate and see what the finish on the fabric is. Especially on rayons. Acetate rayon today, to my mind, is an easier proposition for lacquer printing.

Insofar as the printing rolls are concerned, if you use the same judgment in printing lacquer that you do in your own dye printing, you will come near hitting the nail on the head, with the exception of one thing, and that is the ground. You should not get your grounds too coarse. I believe if your ground is too coarse, the lacquer doesn't spread, and it is advisable to get it ground fine enough so that it deposits evenly; because you don't have the chance for penetration that you do with dyes.

On some dark shades, you must get much deeper rolls than you would on your pastels, because you have to deposit enough lacquer to give you opacity to cover the background color. These lacquers stand dry cleaning and ironing, and washing in warm water with a neutral soap.

You are probably familiar with oil silk. It is a method of coating silk with a resin solution, and baking it at 240° F. for about 20 minutes. It is done this way: They immerse it, and they run it up through a vertical roller. Those rollers are gauged so that they get their desired thickness, and it goes up through a tower, and back, and gets a second immersion.

There are other methods. Instead of using this thin resin solution to make it waterproof, there is a heavy rubber coating applied with a doctor knife, and the same with a lacquer coating. Then it is printed either by spray or roller print.

DISCUSSION

Mr. Briggs: What colors are most expensive?

Mr. Frey: The reds and maroons are most expensive. You can get lacquers for the metallic prints from $2.00 up to $3.00, and your pigmented lacquers anywhere from $2.50 up, the reds, of course, depending on what jobs you are doing. If you are printing shallow prints, you have to get a lot of color in there, and that means money. And your de-lusters run anywhere from a dollar and a half up depending on color.

Mr. Pecox: Mr. Frey, in what way have the dyes fallen down in lacquer printing chiefly?

Mr. Frey: I don't believe the dyes are satisfactory yet. There are some good dyes. The trouble is you have to get a dye that is soluble in your solvents, and that isn't so hard to do. But then that very same dye has to stand washing, and an alkali soap wash, or alkali, and most of them won't stand it. They will bleed.

Mr. Pecox: Is that true if they are applied on the acetate rayon?

Mr. Frey: Yes. I have been speaking to some of the color men on that, and they agree with me that we don't just have the dyes quite right.

There is another thing you have to bear in mind that I failed to mention, and that is that you are not dyeing a piece of material the same as you do in your dye print, which includes fixing the dye and washing out the paste. Here we are just applying a material that is in its raw state, and the color is not developed. It is just there in suspension.

Member: May I ask how strong a soaping you intend to give this lacquer, if it has a dyestuff in the lacquer?

Mr. Frey: Your regular 5 per cent you use today. We have always tested with the 5 per cent, and in most cases you will get a bleed, especially on rayon, more so than you will on silk or acetate rayon.

Mr. Donovan: How fast are the lacquers in dry cleaning?

Mr. Frey: Very good, provided you don't get into ethylene dichloride. It will attack it. In fact, it will attack your acetate rayon too if you leave it in there long enough.

Mr. Briggs: Does the trade have any demand for these semi-damasks?

Mr. Frey: I understand that one of the stores in New York put a warning sign on them: "Do not wash, but dry clean." They want them fast. I said before its field is limited to a certain purpose.

Mr. Briggs: You spoke of heavier shades standing up for 100 hours under a test.

Mr. Frey: Some will go 100 hours.

Mr. Briggs: Pastel shades, I believe, are very sensitive. Have you tried any hour tests on the pastels?

Mr. Frey: We have a pink that will run 100 hours. We have a blue that will do the same thing. But we have no green.

Chairman Baxter: Mr. Frey has some samples here that he would be glad to have you come up and look at.

APPLICANTS FOR MEMBERSHIP

Active

Walter Mueller—Superintendent, Bouchard & Charris Mill, Paterson, N. J. Sponsors: W. A. Stringfellow, R. Fitzgibbon.

Edward Shumsey—Asst. Dyer, Anti Pyros Co., Brooklyn, N. Y. Sponsors: L. A. Winnell, C. C. Knights.

Pierce Stephens Smith—Instructor in Textile Chemistry & Dyeing, Georgia School of Technology. Sponsors: C. A. Jones, W. B. Griffin.

Charles E. Stauffer—Research Chemist, R. R. Street & Co., Inc., Chicago, Ill. Sponsors: A. J. Feit, J. C. Moertel.

Mitchell Stead—Salesman, Calco Chemical Co., Philadelphia, Pa. Sponsors: Wm. Ebersold, H. B. Dohner.

John A. Stinson—Head of cleaning, dyeing and spotting school, Lubbock, Texas. Sponsor: M. E. Heard.

Junior

Persis Bullard—Head of Testing Laboratory, International Braid Co., Providence, R. I. Sponsor: Frederick Mason.

Kenneth S. Campbell—Textile Chemist, Laboratory, Ciba Co., Inc., New York. Sponsors: H. C. Mullner, Geo. Walsh.

Najie Elias Daher—Mill hand. Pacific Mills, Worsted Div., Lawrence, Mass. Sponsors: L. A. Olney, John Smith.

William Arthur Drummond—Mill operative. M. T. Stevens Sons, North Andover, Mass. Sponsors: R. E. Derby, Edward Weber.

Irving I. Herzberg—Dyer, Trucolor Dye Works, Long Island City, N. Y. Sponsors: Ludwig Fusser, J. J. McDonald.

Edward Will Kent—Laboratory Assistant, Althouse Chemical Co., Reading, Pa. Sponsors: E. C. Bertolet, J. E. Goodavage.

Charles Franklin Lauer—Finisher, Delta Finishing Co., Philadelphia, Pa. Sponsors: E. C. Bertolet, J. E. Goodavage.

John E. Lepor—Asst. Colorist and Drug Room Clerk, Hodshow Berg Corp., East Norwalk, Conn. Sponsors: R. J. Carey, W. L. Braun.

Joseph Floyd Oliver—Chemist, Stodghill & Co., Atlanta, Ga. Sponsors: C. A. Jones, W. G. Griffin.

John James Roarke—Dyestuff Chemist, Geigy Co., Inc., Boston, Mass. Sponsors: E. E. Fickett, H. C. Chapin

Paul Lester Shurr—Laboratory Assistant, Althouse Chemical Co., Reading, Pa. Sponsors: E. C. Bertolet, J. E. Goodavage.

Clement Olin Stevenson—Laboratory technician, Ciba Co., Inc., Charlotte, N. C. Sponsors: A. R. Thompson Jr., S. I. Parker.

Ernest M. Taylor—Chemist, Apponaug Co., Apponaug, R. I. Sponsors: J. E. Bolderson, J. L. McKee.

Peter W. Volk—Chemist, E. F. Houghton & Co., Philadelphia, Pa. Sponsors: A. F. Bowles, H. W. Stiegler.

MEETING, LOWELL TEXTILE INSTITUTE STUDENT SECTION

A MEETING of the Lowell Textile Institute Section was held on Thursday, February 3, with Secretary Hugh F. Carroll presiding.

The purpose of the meeting was to elect new officers. Mr. Herman T. Buckley was elected Chairman, and Mr. Robert A. Lemieux Secretary.

Respectfully submitted,

ROBERT A. LEMIEUX, *Secretary.*

MEETING, MID-WEST SECTION

THE Annual Meeting of the Mid-West Section was held Saturday, February 5, 1938 at the Bismarck Hotel, Chicago, Illinois.

Another afternoon discussion was held under the able direction of Mr. Herman Boxser as Chairman.

Dinner was served at seven P.M. Eighty-two members and guests were present.

The meeting was called to order by Chairman E. J. Siegrist. The annual report of the Secretary; Minutes of the Oct. 16, 1937 meeting; and the Annual Treasurer's Report were read and approved.

Clarence Wille acted as Chairman of the nominating committee which was composed of Mr. Wille, E. J. Sindt, A. J. Feit, L. Mullen and A. G. Alexander. The following were elected:

Chairman (re-elected)—Edward J. Siegrist.

Vice-Chairman (elected)—Herman Boxser.

Treasurer (elected)—Gilbert T. Latham.

Secretary (re-elected)—Herbert W. Tetzlaff.

Members of the Sectional Committee—Chas. E. Lennox, Jos. F. Feit, Robert N. Griswold, August C. Orthmann.

Representative to the National Council—B. C. Blowney.

Representative to the National Nominating Committee—Arthur T. Brainerd.

The members and guests adjourned to another room where the Republic Steel Corporation of Cleveland, Ohio, presented their sound film, "The Manufacturing and Application of Stainless Steel", under the able direction of their Mr. Thomas Holt, Jr.

There being no further business, the meeting was adjourned at 10:15 P.M.

Respectfully submitted,

HERBERT W. TETZLAFF, *Secretary.*

MEETING, PHILADELPHIA TEXTILE SCHOOL STUDENT SECTION

A REGULAR meeting of the Philadelphia Textile School Student Section was held on Friday, January 14, 1938, at 4:00 P.M., with Chairman Wayne Fry presiding.

The nominating committee made its report and Mr. Stott was elected to represent the First Year Chemistry and Dyeing Class in the sectional committee.

Mr. Alling of Hungerford & Terry, Inc., addressed the section. His topic was "Softening of Water for Textile Plants" and covered fully this important question of a suitable water supply.

Respectfully submitted,

ROBERT F. ROECKER, *Secretary.*

MEETING, NEW YORK SECTION

THE third regular meeting of the New York Section was held on Friday evening, January 28th, 1938, at the Swiss Chalet, Rochelle Park, N. J., at 8:00 P.M. The usual informal dinner was held at 6:30 P.M. preceding the meeting.

Mr. George Lane of the Van Vlaanderen Machine Company, Paterson, N. J., spoke on "New Developments in Dyeing and Finishing Machinery".

Mr. C. J. Huber, Director of Laboratories, U. S. Testing Company, Hoboken, N. J., delivered a paper on "Some Fabric Defects: Their Causes and Possible Prevention".

These gentlemen, being well informed on their respective subjects, presented interesting talks to the members of our Section who attended this meeting.

Dr. Meili, Chairman of the Program Committee, indicated that Dr. Samuel Lenher of E. I. Du Pont de Nemours & Company, Inc., would present a paper at the next meeting on permanent water-repellent agents.

Also, at the next meeting, Calco Chemical Company offered to present their new motion picture on dyestuffs entitled "Beyond the Rainbow".

Mr. George Baxter, Chairman, indicated briefly that there appeared to be a very decided and popular interest in all types of water-repellent and water-proofing agents in their application to textiles during the past year.

There was a total attendance of eighty (80).

Respectfully submitted,

P. J. KENNEDY, *Secretary.*

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary or the American Dyestuff Reporter any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

Prospective employers may file vacancies either with the secretary or the American Dyestuff Reporter.

A-1

Education—B.T.C., Lowell Textile Institute.

Experience—Two years as chief chemist in cotton mill. Experienced on direct, vats, naphthols, sulfur, basic and developed colors. Two years' experience in protein, fat fiber and mineral control in grains and animal feedstuffs. Age 28.

A-4

Education—University of South Carolina, New York University, Philadelphia Textile School.

Experience—Chemist for 3 years with dyestuff company; 1 year as chemist in dyeing plant on pure and tin weighted silks and rayon; 3 years plant chemist for cotton dyeing, printing and bleaching plant.

Married; age 30; references. Prefers Metropolitan area but will go anywhere.

A-B-1

Education—Graduate chemist and colorist from a leading textile institute. Speaks French fluently. High standing at school. Awarded 1st prize in chemistry. Member of honor society.

Experience—Knowledge of most processes of textile manufacturing and some experience in woolen and worsted piece and stock dyeing and color matching. Knowledge of finishing. Wishes to get into laboratory or dyehouse.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer. Age 31; married.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as Bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-F-1

Education—Textile institute course; extension work at Brown; executive training with Alexander Hamilton Institute; knowledge of German.

Experience—Dyeing executive in all types of textiles, including stock, yarns, and piece-goods. Thorough knowledge of all classes of dyes and dyestuffs, and their successful practical application in the plant. Wide experience in all types and makes of equipment used in dyeing, bleaching, mercerizing and finishing. Laboratory practice in planning and checking methods and processes, costing and purchasing. Good manager personnel for efficiency and satisfactory results economically obtained. Cotton, rayon and silk, some acetate rayon, and mixed fabrics. Age 46; excellent references; in excellent health.

B-3

Experience—Foreman piece dyer for the past 21 years. Can dye the following: celanese, rayon, cotton backs, wool, silk and mixed fabrics. Has knowledge of finishing and laboratory work.

B-4

Experience—Foreman dyer in charge of ribbon dyeing for 20 years. Experienced on silk, cotton, rayon, acetate yarn. Age 41; will go anywhere.

B-5

Education—High School and Textile School Graduate.

Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Textile School Graduate.

Experience—Former instructor in chemistry and dyeing. Twelve years' experience as overseer of dyeing of vats, naphthols, developed, indigosols, sulfur and direct colors on piece goods. Age 35; excellent references.

Physical and Chemical
Textile Testing-VI

JOHN H. SKINKLE*

PART I—PHYSICAL TESTING

(Continued from November 15, 1937 issue)

CHAPTER 7—FABRIC TESTING (Continued)

THERMAL PROPERTIES

THE thermal property of a fabric is its ability to resist or permit the passage of heat. In winter clothing, of course, warmth is desired; in summer clothing, coolness is necessary. Intimately associated with thermal properties are porosity and permeability, since the warmth of any fabric is due to the dead air space and not actually to the fiber itself; also, to be comfortable, clothing must allow evaporation of moisture from the body and so must have a certain amount of permeability. We have already considered porosity and permeability and will now concern ourselves with the measurement of thermal properties alone.

There are three common methods of measuring the thermal insulating value of fabrics:

1. Disc or plate method.
2. Constant temperature method.
3. Cooling method.

In the disc or plate method, the fabric is held between two plates at different temperatures and the rate of flow of the heat through the fabric is measured. If pressure is exerted on a fabric, its properties are altered—if the pressure is great enough to get good thermal contact between the plates and the fabric the change in properties is considerable; if the pressure is small the thermal contact is poor and the surface resistance to the flow of heat may be large enough to cause serious error in the determination. Results obtained by this method therefore are the thermal conductivities of compressed fabrics under a pressure which must be stated in order to be reproducible. Speakman's modification of this method consists in using two calorimeters with the fabric between supported at constant thickness. The thermal conductivity of any material is given by the formula:

$$k = \frac{QL}{TA(t_1-t_2)}$$

where Q = heat transmitted in calories
L = thickness of material in centimeters
A = area of sample in square centimeters
T = time in seconds
t_1-t_2 = temperature difference between the two sides of the material in degrees Centigrade
k = thermal conductivity

It is obvious that this method involves accurate heat measurements as well as accurate thickness control.

In the constant temperature method, a body is wrapped with the fabric to be tested and is maintained at a constant temperature by a controlled source of energy (usually electric heaters); the amount of energy required to maintain the body at the fixed temperature is determined—an electrical measurement which is easier and more accurate than the measurement of heat energy. This method has been used by Haven, the Bureau of Standards, Marsh, and Angus in making very accurate comparisons of thermal insulating values. Absolute determinations cannot be made, so that comparisons of results are possible only when the same instrument is used.

In the cooling method, we have a hot body wrapped in the fabric to be tested and the rate of cooling is measured or, more usually, the time required for the body to cool a given number of degrees. The results apply only to the apparatus used and cannot be compared with another worker's, but for comparisons of different fabrics in one laboratory the simplicity of the method and apparatus makes it very valuable. Black and Matthew have used this method in the form of a katathermometer—an alcohol thermometer with a cylindrical bulb about 4 centimeters long, 2 centimeters in diameter, and with a stem 20 centimeters in length with two graduations at 100°F and 95°F (temperatures just above and just below body temperature). On this apparatus, it was found that relative humidity had no effect, a further simplification. The cloth is made into a cylinder by wrapping on a wooden form, marking, and sewing. Tabs are left at the bottom and top of the cylinder to fasten on ebonite rings by means of shellac. The whole apparatus is placed in an enclosure at constant temperature (18.5°C was used by Black and Matthews) and the time of cooling from 100° to 95° is noted with the fabric and without the fabric. The thermal insulating value is given as: time of cooling when clad/time of cooling unclad. This ratio varies from 0.69 to 0.96 for the "comfort zone"; a ratio greater than 0.96 would be too warm and less than 0.69 would be too cold.

A crude variation of this method for comparing fabrics would be to surround a beaker or small can with the fabric, place it inside a larger beaker or can, pour in a definite weight of water at about 105-110°F and observe the time required to cool between 100° and 95°F. The author has used an improved version of this rough

*Department of Chemistry, Lowell Textile Institute, Lowell, Massachusetts.

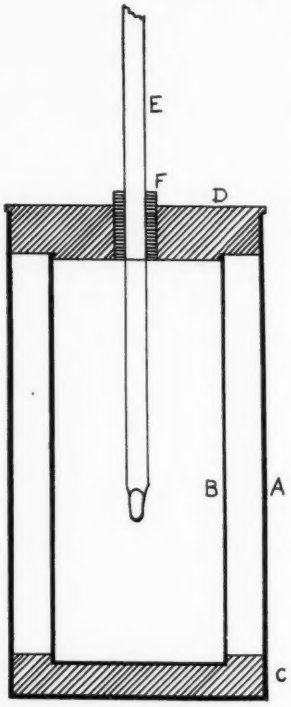


Fig. 29
Apparatus for Determination of Thermal Insulating value.

method using apparatus which can be easily made up. The apparatus (Figure 29) consists of a large copper can (A) 3 inches in diameter and 5¾ inches high, with a sheet asbestos bottom (C) and a sheet asbestos lid (D) into which is put a rubber stopper (F) containing a thermometer (E). A smaller copper can (B) of 2 inches diameter and such a height as to reach from the lid to a depression in the bottom (in order to center the inner can) contains 200 cubic centimeters of water when the level is nearly to the top. In use, the fabric is placed around the inner can, and the whole is set into place in the outer can. Two hundred cubic centimeters of water are heated in a beaker to 105-110°F and poured into the inner can, the lid and thermometer put in place and the time for the water to cool from 100° to 95°F is measured. The apparatus is not accurate enough for absolute determinations, but is sufficiently so for comparisons of various fabrics when made by one tester. The results may be calculated to thermal insulating value as in the katathermometer method. Loose fiber masses may be tested by filling the annular space between the cans with equal weights or equal volumes of fiber.

The use of these different methods of measuring thermal insulating value has shown several very important facts about the warmth of fabrics. The fiber used has little importance in itself on the warmth of the fabric, but only as it affects the porosity and permeability of the fabric or as it affects the permanence of the warmth. For example, cotton and woolen fabrics may be made identical in warmth, but after use the cotton would mat down and be less porous (have less dead air space), whereas the resilience of the wool fabric would bring it back it its original porosity; the cotton fabric would therefore be less warm after use, whereas the wool fabric would retain its warmth. It has also been shown that napped fabrics are warmer than unnapped and loose garments are warmer than tight; these effects again being due to the dead air space formed. Fulling decreases the permeability to air but increases the warmth of a woolen fabric, the porosity remaining about the same; in this case, fulling has decreased the size of the individual air spaces but increased the number of such spaces so that a greater warmth is obtained.

REFERENCES

[1]Haven, G. B., Mechanical Fabrics, John Wiley and Sons, Inc., New York, 1932.
[2]Speakman, J. B. and Chamberlain, N. H., Thermal Conducitivity of Textile Materials and Fabrics, Journal of the Textile Institute *21*, T29 (1930).
[3]Marsh, M. C., Thermal Insulating Properties of Fabrics, Journal of Textile Institute *22*, T245 (1931).
[4]Black, C. P. and Matthew, J. A., Physical Properties of Fabrics in Relation to Clothing, Journal of the Textile Institute *25*, T197, T249 (1934).
[5]Angus, T. C., Heat Retaining Properties of Clothing, Computed on a Physiological Basis, Journal of the Textile Institute *26*, T83 (1935); *27*, T273 (1936).

HANDLE OR DRAPING QUALITY

This quality of a fabric is now expressed only by the qualitative judgment of an expert who, on feeling, bending, and crushing a fabric in his hands describes it as "soft", "harsh", "boardy", "lofty" or in some other terms which mean little to a non-expert and which do not allow accurate comparisons with other fabrics or with comparisons of the feel to other experts. Handle is a very complex mixture of properties which are unconsciously integrated or summed-up in the mind of the expert. The main, but probably not the only, factors in handle are:

1. Weight—this determination has already been given in Chapter 5.
2. Stiffness or limpness—the resistance to or ease of bending of a fabric.
3. Hardness or softness—the resistance to or ease of compression.
4. Smoothness—the friction of the fabric on the fingers.
5. Resilience—the ability of the fabric to resume its former volume, thickness, or shape after compression or bending.

No one instrument will determine all of these but each one may be determined separately.

Stiffness of a fabric may be measured in one of several ways. The method of MacNicholas and Hedrich consists in folding a strip of fabric 3x9 inches in size back on itself and measuring the height of the fold when compressed by various loads; this method requires only a thickness gauge with a variable load attachment. The method of Peterson and Dantzig is illustrated in Figure 30; the strip of fabric is fed by rubber covered rolls horizontally across a plane surface upon which is a metal bar at an angle B'BC of 45°, this bar is calibrated in millimeters and the point C at which the fabric

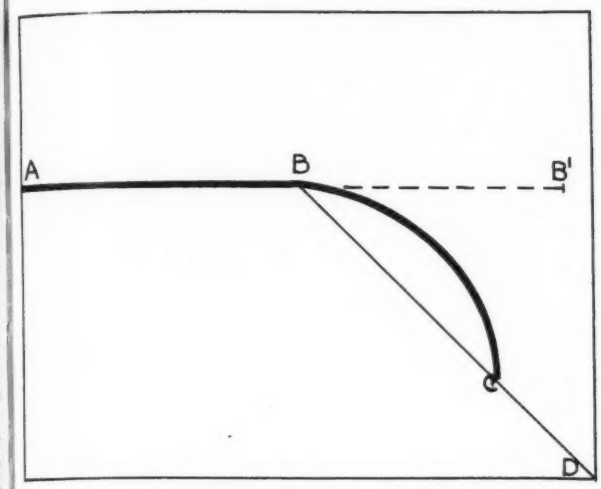


Fig. 30—Principle of Determination of Stiffness of a Fabric.

touches the bar is observed, the distance BC being a measure of the stiffness of the cloth. A simpler method suggested by the author is to have a horizontal plane AB and a plane BD at 45°; the strip of fabric is placed on the horizontal plane with a metal rule above it, the end of the rule coinciding with the end of the fabric; the rule and strip are then moved to the right, the strip bending over and eventually touching the angular plane at which time the end of the rule is at B'; the distance BB' read from the rule is then a measure of the stiffness. This apparatus might easily be made in the laboratory and is simple to operate. Peirce has described a more complicated method which in principle is the same as the above except that a known length of cloth is allowed to bend over and the angle B'BC is measured; he then calculates the bending length:

$$C = L \left(\frac{\cos a/2}{8 \tan a} \right)^{1/3}$$

when C = bending length
L = length of the overhanging fabric
a = the angle B'BC

Peirce suggests that the resistance to bending which would be felt by the fingers is due to the flexural rigidity which may be calculated:

$$G = WC^3$$

when G = flexural rigidity
W = weight per unit area of the fabric

To compare the stiffness of materials of different thicknesses, the bending modulus may be calculated:

$$Q = KG/d^3$$

when Q = bending modulus
d = thickness
K = a constant

Peirce also suggests a method called the heart loop method for use on very soft materials where the stiffness cannot be obtained by the previous methods. A strip of fabric of length L is folded back on itself and clamped so that it hangs in a heart-shaped loop (Figure

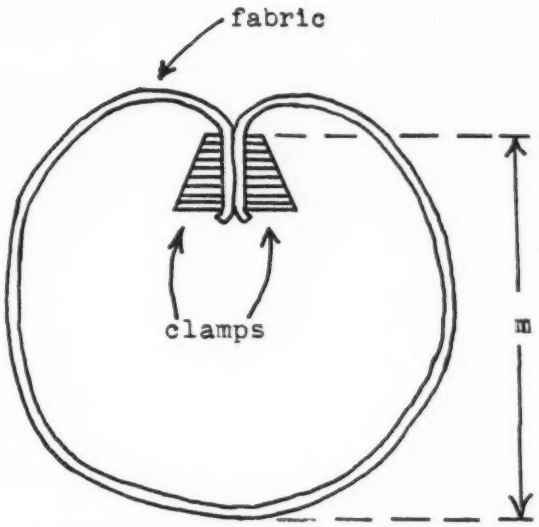


Fig. 31—Heart Loop Method for Stiffness of Fabric.

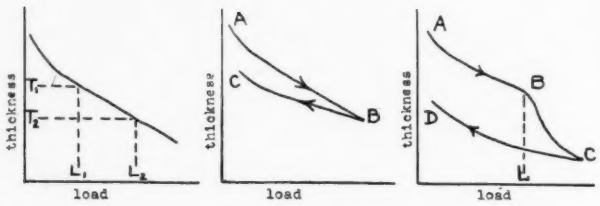
31). If the fabric were very stiff the length of the loop (m) would be 0.1337L, but if the fabric were completely limp (and the clamps were very thin) the loop would have a length (m) of 0.5L. If the length of the loop is measured, the stiffness is inversely proportional to the length (m) or the limpness is directly proportional to the length, between the above limits. Calculations may also be made as in Peirce's other method:

Let n = 0.1337L
and S = m — n
Then a = 32.85° x S/n

$$\text{and } C = n \left(\frac{\cos a}{\tan a} \right)^{1/3}$$

Schiefer describes a "Flexometer" in which a pair of test specimens of standard dimensions are mounted in the vertical angles formed by two vertical intersecting plates, one fixed and the other moveable on a spindle. The work done in folding the specimens to various angles between the plates is measured by the deflection of a calibrated spring. Saxl has devised a stiffness tester in which a strip of cloth is held by clamps at one end, the other end resting on the pan of a balance. The balance is set for a definite weight and the clamp is rotated, a pointer indicating the number of degrees, until a balance is reached. This instrument therefore measures the force required to bend the fabric. For occasional use only, the simplest methods of determining stiffness are the method of MacNicholas and Hedrich, the method of Peterson and Dantzig (or the author's modification) and the heart loop method of Peirce. Peirce has shown that the stiffness of a fabric as a whole is the geometric mean of the stiffnesses of the warp and the filling; that is, the stiffness warp-wise and the stiffness filling-wise are measured, multiplied together, and the square root of the product obtained.

The hardness of a fabric depends upon the measure-



a
Ordinary Fabric Increasing Load.

b
Ordinary Fabric Increasing and Decreasing Load.

c
Pile Fabric Increasing and Decreasing Load.

Fig. 32—Typical Thickness-Load Curves for Fabrics.

ment of the thickness of the fabric under varying loads. If the thickness is plotted against the load a curve similar to Figure 32a is obtained, consisting of a small curved portion and then an approximately straight line. Peirce suggests the measurement of the thicknesses (T_1 and T_2) at two loads (L_1 and L_2) on the straight-line portion of the curve; the hardness of the sample (H) is then given as:

$$H = (L_2 - L_1) / (T_1 - T_2)$$

Schiefer describes the "Compressometer," a combination of two thickness gauges mounted with a rack and pinion to move vertically through a helical spring. The lower thickness gauge reads the thickness of the fabric, the upper thickness gauge reads the deflection of the spring which combined with the calibration of the spring gives the load on the fabric. Schiefer defines the compressibility of a fabric as rate of decrease of the thickness at one pound per square inch pressure divided by the thickness at the same pressure, using the straight line of Figure 32a to get the slope which is the rate of decrease of thickness; or using the same symbols as before:

$$\text{Compressibility} = \frac{T_1 - T_2}{T_1(L_2 - L_1)}$$

If the Compressometer is used with a pile fabric, a curve similar to the upper one of Figure 32c is obtained; in this AB represents the thickness of the pile, L is the crushing load, and BC represents the bending of the pile.

The most convenient method for measuring the smoothness of a fabric is that of Mercier. A block covered with a sample of the fabric to be tested is placed on an inclined plane covered with the same material. The angle between the inclined plane and the horizontal when the block just begins to slide is measured; owing to a rearrangement of the fibers in the surface of the fabric, this angle decreases with successive slides, therefore a number of slides is made until a constant angle is found. It may be shown that the coefficient of friction of the fabric on itself is equal to the tangent of the angle of slide. A low coefficient is desirable in the lining of coat sleeves, shoe linings, and sleeping garments while it is undesirable in the backing of rugs.

The resilience of a fabric is obtained by measuring the deformation of the fabric on increasing load, then decreasing the load and measuring the deformation. The two curves are plotted and the area under each curve measured by a planimeter or by taking a number of measurements:

$$\text{Resilience} = \frac{\text{area under curve of decreasing load}}{\text{area under curve of increasing load}} \times 100$$

A simpler method consists in measuring the deformation D_1 under a light load L_1, then increasing the load to L_2 and measuring the deformation D_2; the excess load is then removed to obtain load L_1 again and the new deformation D_3 is measured. Then

$$\text{Resilience} = 100(D_2 - D_3) / (D_2 - D_1)$$

This determination may be applied to many of the stiffness or hardness determinations already described. The Haven method for fiber resilience described in Chapter 3 may be used for fabrics also. The Mac Nicholas and Hedrich method for stiffness may be run with decreasing loads and the resilience measured. Schiefer's Flexometer and Saxl's apparatus may also be used to determine resilience. A variable load thickness gauge or Schiefer's Compressometer will give curves as in Figures 32b and 32c and may be used to measure resilience.

Amick has described a method of measuring the crease-resistance of fabrics which really measures the resiliency of the fabric after creasing. Strips of fabric are cut out 4 centimeters long and 1 centimeter wide, warp-wise and filling-wise, and are allowed to condition, after which they are handled only with forceps. Each strip is folded in half (2 x 1 centimeters), placed on a glass plate, and a 500 gram weight is placed on it for 2 minutes (by stopwatch). The weight is removed, the strip is placed on a taut wire for 2 minutes, and then the distance between the ends of the strip is measured. This distance in centimeters divided by 4 and multiplied by 100 is the per cent resilience of the sample.

The handle or draping quality of cloth is of great importance in the application of starch to fabrics, in the calendering of cotton, in woolen and worsted finishing, and in the determination of the crease resistance of fabrics. The introduction of the synthetic resins for crease-proofing fabrics and the introduction of various softeners for use in finishing fabrics also make it necessary to give a quantitative value to the various factors which affect the handle of the cloth. It may be noted that three of these factors—stiffness, hardness, and resilience—may all be measured by a variable load thickness gauge (if the MacNicholas and Hedrich method is used for stiffness); the other determinations—softness (by heart loop), smoothness, and weight—are measurable by simple apparatus which may be constructed in the laboratory.

REFERENCES

[1]Peterson, E. C. and Dantzig, T., Stiffness in Fabrics Produced by Different Starches and Starch Mixtures and a Quantitative Method for Evaluating Stiffness, U. S. Dept. of Agriculture, Tech. Bull. No. 108 (1929).

[2]MacNicholas, H. J. and Hedrich, A. F., Structure and Properties of Parachute Cloths, Nat. Adv. Com. for Aeronautics Tech. Note, No. 335 (1930).

[3]Mercier, A. A., Coefficient of Friction of Fabrics, Bureau of Standards Journal of Research *5*, 243 (1930).

[4]Schiefer, H. F., Flexometer, an Instrument for Evaluating the Flexural Properties of Cloth and Similar Materials, Bureau of Standards Journal of Research *10*, 647 (1933).

[5]Schiefer, H. F., Compressometer, an Instrument for Evaluating the Thickness, Compressibility, and Compressional Resilience of Textiles and Similar Materials, Bureau of Standards Journal of Research *10*, 705 (1933).

[6]Peirce, F. F., "Handle" of Cloth as a Measurable Quantity, Journal of the Textile Institute *21*, T377 (1930).

[7]Amick, C., Crease-Resisting Fabrics, American Dyestuff Reporter *24*, 553, 622, 645 (1935).

[8]Stiffness Tester (Saxl), American Dyestuff Reporter *26*, 620 (1937).

[9]Schiefer, H. F., Evaluation of Crush Resistant Finishing Treatments for Fabrics, American Dyestuff Reporter *26*, P667 (1937).

SERVICEABILITY, WEAR, ABRASION

These three terms are often used interchangeably but in reality there is a distinction. "Serviceability" of a fabric is its length of life up to its end of usefulness which is when one necessary property becomes deficient. In clothing, for example, the end of service is generally when due to color fading, shrinkage in laundering, or bagging at knees or elbows, the garment no longer has a presentable appearance; clothing seldom wears out, although some examples of actual wear may be found. The serviceability of tent cloth is determined by its waterproofness; the serviceability of canvas belting or shoe lining, on the other hand, is determined by actual wear. "Serviceability," then, is an indeterminate quality and depends on the length of time or amount of use a fabric may endure before its most desirable property becomes insufficient to give it the properties desired.

"Wear" is the amount of deterioration of a fabric due to breaking, cutting, or removal of the fibers. In certain cases such as the belting or shoe linings quoted above, "wear" and "serviceability" are probably the same but in most cases they are distinct. Wear is also an indeterminate quality because conditions of wear vary so much and also because we do not know quantitatively the effect of the different factors involved in wear. Qualitatively, we believe the following to be the factors causing wear.

1. Direct force on the fabric—this never occurs in normal wear but only under abnormal stress.
2. Impact effects—important only in floor coverings.
3. Flexing; or friction of fiber on fiber and yarn on yarn due to bending of the fabric—this is ordinarily unimportant because it results in very slow wear; in the case of sized or coated fabrics, however, it is very important.
4. Abrasion
   a. Friction of cloth on cloth—occurs only locally, such as the rubbing of the sleeve on the coat.
   b. Friction of the cloth on external objects—probably the most important factor.
   c. Friction of the fibers on the dust or grit in the fabric, resulting in cutting of the fibers—the importance of this factor depends upon the character or the use of the fabric and the frequency and thoroughness of cleaning.

From the above, it will be seen that abrasion is the most important factor in wear in most cases and that abrasion consists of friction between the cloth and some other material. For purposes of testing, this material must be quite rough so as to give a quick result, but the selection of this rough abrasive may be contrary to the ordinary conditions of use of the fabric. This should be borne in mind in considering the results of abrasion tests.

The main factors in abrasion, in addition to the temperature and relative humidity of the atmosphere which should always be at standard conditions, and their general effects are:

1. Character of the motion.
   a. Rotary.
   b. Reciprocating.

In general, reciprocating motion is better because the effect of abrasion may be studied on the warp and filling separately.

2. Nature of the abradant.
   a. The sample itself.
   b. A standard cloth, usually canvas.
   c. A steel surface.
   d. Carborundum, emery cloth, or emery paper.

If the sample itself is the abradant, a long period of abrasion is required and different cloths are not comparable with each other. If a standard cloth is used, variations are very apt to exist so that results obtained at one time cannot be compared with results obtained at another time. A steel surface is also very variable not only from one machine to another but in the same machine after different periods of wear. The use of carborundum or emery cloth is now almost universal; although admittedly unlike real wear, it gives rapid results and can be obtained quite uniform.

3. Pressure of the abradant on the sample.

This effect is very great, usually a linear relationship exists between the pressure of the abradant and the amount of abrasion. The pressure, therefore, must be standardized.

4. Tension on the sample.

This effect is also large and the tension must be standardized.

5. Removal of lint.
   a. By a vacuum attachment.
   b. By running the machine at high speed so that the lint is thrown out.
   c. By rocking the abradant to brush out the lint.

Accumulation of lint in the abradant or in the sample tends to clog the machine and reduce the amount of abrasion.

6. Determination of end point or amount of abrasion
   a. Number of strokes required to wear a hole. This appears the most logical but actually is affected by so many variables that it is rather

indeterminate; it is, however, considerably used.

b. Loss in strength after a definite number of rubs. This is used in most cases and seems to give most satisfactory results. A large enough area must be abraded, then, to give sufficient strength tests to obtain a satisfactory average.

c. Loss in thickness after a definite number of rubs. This is used only on felts, carpets, and napped fabrics where considerable abrasion may occur before any loss in strength takes place. In general, thickness determinations are unsatisfactory.

d. Loss of weight after a definite number of rubs. This method is used on heavy plushes and deep pile goods where thickness determinations are least satisfactory; it is not used on ordinary woven goods because of the possibility of the cloth picking up pieces of lint or abradant.

e. Change in porosity, compressibility, heat insulation, water absorption, or other properties. These are used only in very special cases.

Numerous abrasion machines have been described in the literature and for most of these the reader is referred to the survey by Ball of the machines commercially available; these include the following machines together with the manufacturer or dealer: Amsler Wear Tester sold by Herman A. Holz, New York; M.I.T. Abrasion Machine made by Hamblett Machine Co., Lawrence, Mass.; Perspirator by Industrial By-Products and Research Corp., Philadelphia, Pa.; Shawmut Wear-Testing Machine made by Shawmut Engineering Co., Boston, Mass.; U. S. Testing Co., Inc., Abrasion (Wear Test) Machine made by United States Testing Co., Inc., Hoboken, N. J.; Wyzenbeek Precision Wear Test Meter made by Wyzenbeek and Staff, Inc., Chicago, Ill.; Schopper Abrasion Tester sold by Testing Machines, Inc., New York. Perhaps the most frequently used in this country and the least unsatisfactory in the author's opinion is the M.I.T. model described by Haven. In considering this machine, we might first note how it compares with the factors given above.

1. The sample is a strip of cloth 26 inches long and 6½ inches wide which is abraded by a longitudinal reciprocating motion so as to abrade 18 inches of sample; 1½ inches at each end is abraded unevenly, the 15 inches in the middle is abraded at uniform speed.

2. The abradant for general use is No. 000 emery cloth; for carpets and materials which are doped or coated, No. 00 garnet paper is recommended.

3. The pressure of the abradant on the sample may be varied. It is suggested that a pressure equal to the number of ounces per square yard of the fabric be used.

4. The tension on the sample may be varied from one pound up. It is suggested that tensions be as follows:

Light fabrics	up to 7 oz/sq yd	1½ lbs
Medium fabrics	7 - 15 oz/sq yd	2 lbs
Heavy and coated fabrics	above 15 oz/sq yd	2½ lbs

5. Removal of lint is accomplished by having the abradant free to rock. This rocking occurs with a snap at each reversal of direction of motion and threws off any lint formed by the previous stroke.

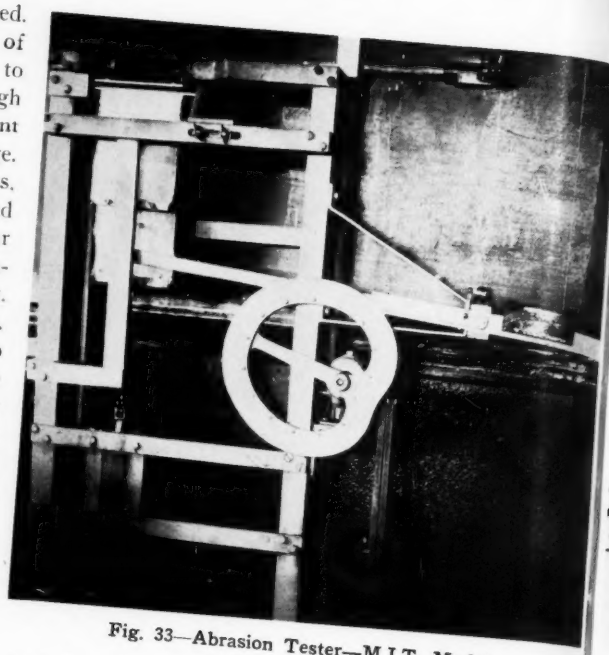


Fig. 33—Abrasion Tester—M.I.T. Model.

6. The amount of abrasion is determined by giving the per cent loss in strength after a definite number of rubs. A revolution counter gives the number of double rubs and the size of the sample is such that ten strip or four grab tests may be made on the abraded surface.

In addition to the above factors, this machine includes flexing of the cloth over a roller moving in ball bearings. The diameter of the roller controls the amount of flexing and the following sizes are suggested:

Light fabrics	up to 7 oz/sq yd	¼ inch dia.
Medium fabrics	7 - 15 oz/sq-yd	½ inch dia.
Heavy fabrics	above 15 oz/sq yd	1 inch dia.

A horizontal roller in ball bearings is mounted in the frame and over this is draped the sample; one end of the sample is clamped to a block which slides in vertical guides, the other is attached to a dead weight tensioning device. The sliding block is driven by a connecting rod and crank and by means of a heart-shaped cam is given 18 inches of linear motion of which the first 1½ inches is accelerating, the last 1½ inches is decelerating, and the middle 15 inches is uniform speed. The normal speed of operation is 55 to 60 r.p.m. of the cam, the source of power being a ½ horsepower motor equipped with a rheostat and a speed reducing device. The abradant is stretched flat on a rocking plate and is fastened by screws; in the rocking plate, at each end, are two posts loosely fitting the top bars of the machine. In the machine, the yarns which are perpendicular to the direction of motion receive the most wear, so two tests are usually made—one each on warp and filling. To measure the tendency of a cloth to "wear shiny," a glass rod may be used instead of abradant and the increase in gloss measured with a photometer.

The results obtained on an abrasion tester are comparative only. In many cases, the order of resistance of fabrics to abrasion is also the order of wear, as far as we can tell; but in many other cases the order is different. The abrasion test must not be considered as imitating wear because wear is such a variable process and we have no means to measure it; still less should the abrasion test be considered a measurement of serviceability; the abrasion test is simply a test of the quality of the fabric as to its resistance to a combination of flexing and cutting of the fibers and its results should be considered in connection with other tests and not as a single criterion of the suitability of a fabric for a given use. The tester should continually keep in mind that abrasion is not the only factor in wear, and wear is not the only factor in serviceability.

REFERENCES

[1]Haven, G. B., Mechanical Fabrics. John Wiley and Sons, Inc., New York, 1932.

[2]Ball, H. J., Abrasion and Wear Testing Machines for Textiles, A.S.T.M. Bulletin No. 89, 11 (1937).

[3]Matthew, J. A., Cloth Wear Testing Machine, Journal of the Textile Institute *21*, T546 (1930).

[4]Crawshaw, H. Morton, W. E., Brown, K. C., Experiments in Fabric Wear Testing, Journal of the Textile Institute *22*, T64 (1931).

[5]Davis, W. and Buckley, G. H., Abrasion Testing of Knitted Textiles, Journal of the Textile Institute *25*, T133, (1934).

[6]Conference on Serviceability of Fabrics, Journal of the Textile Institute *28*, P173 et seq. (1937).

[7]Harvey, E. H., Wyzenbeek Precision Wear Tester Meter, American Dyestuff Reporter *21*, 177 (1932).

(To be continued)

TRADE NOTES • NEW PRODUCTS

OBITUARY

ROBERT J. KELLER

ROBERT J. KELLER, president of Geigy Company, Inc., died at his home in Summit, N. J., on January 13th, 1938. He was born on February 12, 1860 and attended Brooklyn Polytechnic Institute which he left on June 17, 1876 to enter the employ of his father's firm, Fischer & Keller, New York City, as an office

boy, continuing the study of chemistry by attending night school.

One department of his father's firm was devoted to the sale of aniline colors, sumac and nutgall extracts manufactured by the Geigy Aniline & Extract Works, Basle, Switzerland, and in time Mr. Keller came to devote his attention to this business. In 1833 he and his brother Ernest were admitted to the firm (Mr. Fischer having died in 1880) and upon the death of their father in 1885 the two brothers continued the business, greatly increasing the sales of the dyestuff department. A younger brother, Alfred, was admitted to the firm in 1895. The elder brother died in 1900 and the firm was incorporated under the title of John J. Keller & Co., Inc. John C. Garnaus, who had been associated with the firm, was also interested in the corporation. In 1903 the Geigy Aniline & Extract Works became interested financially in the corporation and its name was changed to Geigy Aniline & Extract Co. with Mr. Keller President, John C. Garnaus Secretary and Alfred D. Keller Treasurer. The new corporation was concerned solely with dyestuffs. Mr. Keller spent several years traveling through the South and East and in 1907 took over the management of the Boston office, where they had been previously represented by J. A. & W. Bird & Co. and later by F. E. Atteaux & Co., and remained there until 1913. Mr. Garnaus died in 1909 and Alfred Kuebler, a representative of the Basle company, was made vice-president and a member of the board of directors. In 1910 the company was reorganized under the name of Geigy-ter-Meer Company due to arrangements made abroad between J. R. Geigy S.A., successors to Geigy Aniline & Chemical Works, and Weiler-ter-Meer Co., Uerdingen, Germany. Mr. Kuebler died in December, 1913, and Walter Saenger, representative of the Swiss Company, was elected vice-president and a member of the board of directors.

The present company, Geigy Company, Inc., was incorporated in 1916 with Mr. Keller as president and Mr. Saenger as first vice-president and treasurer which office he still occupies. Mr. Keller held the office of president until his death.

He is survived by his widow and a son, Robert J. Keller.

• CARBIC RELEASE

Carbic Color & Chemical Co., 451-453 Washington St., New York City announces the release of the following shade card:

Indigosol Prints on Cotton Material—which illustrates these colors and includes all the faster types now available. The pattern card contains complete directions for the several methods of application now chiefly in use, and the fastness to light, washing and chlorine is indicated for each Indigosol. Shade card Sol. K. 66.

• CIBA REVIEW

Copies of *Ciba Review*, No. 5, which discusses the subject of tapestries, have recently been distributed. The contents of this issue include: The Development of the Style of Pictorial Gobelins; The Great Age of Tapestry-Weaving in France; The Technique of Tapestry-Weaving; The Origins of Tapestry-Weaving; Notes on the History of Tapestry-Weaving in England; Historical Gleanings; Technical and Scientific Notes. Also included is a supplement on Chlorantine Fast Blue 3 G L L and Chlorantine Fast Green 5 G L L which are said to possess the highest fastness to light obtainable with the direct color range. Copies of *Ciba Review* are available upon request to Ciba Company, Inc., Greenwich & Morton Sts., New York, N. Y.

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson St., New York City, announces release of the following shade card and circulars:

Algosol Prints on Cotton Material—which shows all the Algosol brands recommended by the manufacturers for printing and which gives in detailed text the three different processes by which such prints are handled. Shade card Sol. K. 66.

Indanthrene Scarlet G K Suprafix—which is recommended by the manufacturers for printing on cotton and rayon producing a bright shade said to be of excellent fastness to light and weather even in very light prints. It is also said to have very good fastness to washing and chlorine. Circular I. G. 1381.

Supramine Pure Blue G L—a new ad-

dition to the line of Supramine dyestuffs. Dyed from a weakly acid bath, it produces on wool, bright greenish blues said to be of good fastness to light, water, salt-water, washing and perspiration and is therefore of special interest to the knitting trade. It is also said to stand a medium fulling and to be of very good fastness to carbonizing and decatizing; chroming turns the shade slightly duller. It is further said to exhaust well from a neutral bath, to be useful in union dyeing and to have good affinity for pure and tin-weighted silk. Circular I. G. 1419.

• AFTER THIRTY YEARS

Commemorating its thirtieth anniversary, American Cyanamid Company issued a booklet entitled "After Thirty Years". The Company was founded in 1907 for the manufacture and sale of a single nitrogen fertilizer material. Today Cyanamid employs approximately 10,000 individuals and serves more than a hundred industries. American Cyanamid Company and its subsidiaries today form a well-rounded enterprise supplying products to every important industry using chemicals in its processes. American Cyanamid Company, the parent company, maintains general supervision of the entire Cynamid organization and engages directly in the manufacture and sale of fertilizers, mining chemicals and "Beetle" resins. Among the subsidiaries of Cyanamid are the following: *Calco Chemical Company*, acquired in 1929, specializing in coal-tar intermediates, dyestuffs, and other organic and heavy chemicals; *American Cyanamid & Chemical Corporation*, originally the Kalbfleisch Corporation, acquired in 1929, serving the general industrial chemical fields; *Lederle Laboratories, Inc.*, acquired in 1930, producing a wide line of specialties such as serums, antitoxins, vaccines, and similar products; *Davis & Geck, Inc.*, a subsidiary of Lederle, manufacturing and selling surgical sutures and certain specialties; *Chemical Construction Corporation*, purchased in 1930, contracting for the engineering and construction in any part of the world for many types of chemical plants; *North American Cyanamid Limited*, a Canadian corporation, organized in 1934 to take over the operation of Cyanamid's plants in Canada, producing and selling chiefly mining and fertilizer chemicals; *Dillons-Klipstein Limited*, handling the sales of industrial chemicals in Canada; *Southern Alkali Corporation*, (owned jointly by Cyanamid and Pittsburgh Plate Glass Company) formed in 1933, alkali.

Modern laboratories for research, development and sales service work are maintained at Niagara Falls, Ont., Bound Brook, N. J., Bridgeville, Pa., Pearl River, N. Y. and Stamford, Conn. A highly trained scientific staff is engaged in fundamental investigation directed to the preparation or synthesis of new and useful products from available raw materials, to the development of more economical processes of manufacture and to the search for new uses for established production.

• CONTRAHELIOS

Hungarian chemists have developed a special dye called "contrahelios" which protects against the sun's rays, it is reported to the American Chemical Society. The application of a layer of this dye on window panes filters the destroying ultraviolet rays.

• DYES IN PATHOLOGIC DIAGNOSIS

The most communicable of all contagious diseases is measles. It spreads much faster than its nearest morbid rivals, smallpox and influenza and it infects practically every person exposed to it, unless he has been immunized by an attack of the disease. The symptoms are well known, but the cause of measles was—until few weeks ago—uncertain. An early diagnosis of this malignant disease in regions not readily accessible to visual or manual examinations, was practically restricted to its [illegible] obvious stage.

Now we are able to overcome that helpless position by bringing *to sight* the by-products of the measles virus, known as inclusion bodies, by microscopic examinations of a specimen of mucus from the nose and throat, stained by Blue-Black Nigrosine, if present, rapidly, in a moment's time.

This medium provided the earliest conclusive diagnostic information, so important and essential to check and forestall complications in the victim's condition.

• DRY CLEANING RESEARCH

Arthur D. Little, Inc., industrial chemists of Cambridge, Mass., announce that they have retained the services of Dr. Ralph G. D. Moore to conduct research work planned under the Drycleaning Fellowship provided by the Institute for Maintaining Drycleaning Standards.

Dr. Moore obtained his doctorate in 1936 at McGill University, Montreal, and has just terminated a post-doctorate fellowship at the same university investigating soap-phenol-water systems and their possible connection with the action of certain detergents in the purification of rayon wood pulp. His researches in drycleaning solvents and detergents will be conducted under the supervision of the Arthur D. Little, Inc. organization and with the cooperation of a Research Committee composed of several authorities outside the Arthur D. Little, Inc., research staff.

Cuts to illustrate new machinery for this section should be 2¼" wide. Halftones should be 120 screen.

CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED: Finishing plant chemist desires responsible position. Expert on vats, napthols and other cotton and rayon dyeing. All types of control work and testing. 26 years' experience on yarn and piece goods. Write Box No. 993, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED—Experienced salesman, residing in New York City or vicinity, with ready contacts in the East, by a very progressive and growing textile chemical manufacturer with a varied line to meet any textile requirement. More recently a number of outstanding products have been created for the silk hosiery field. Write Box No. 988, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED— Chemical engineering graduate—1936—interested in chemical sales. Experienced selling textile oils and specialties. Desires position with reliable concern. Write Box No. 109, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.